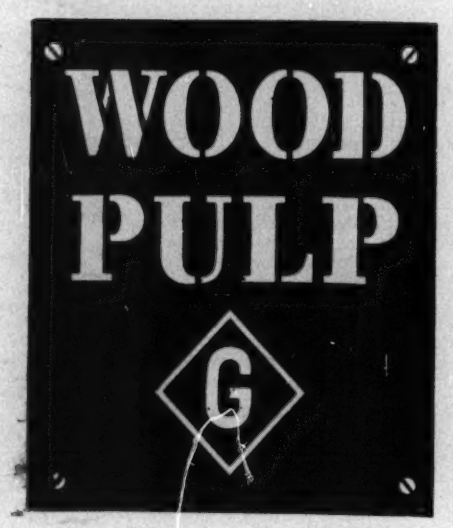
Paper

Jan. 26, 1951

HOW CAN SAWMILL WASTE BE REDUCED?

HOW CAN YOU BEAT CORROSION IN THE PAPER INDUSTRY?



Established 1886

"Storms make oaks take deeper root."
GEORGE HERBERT

The miracle that is called America has evolved despite domestic crises and great international struggles.

America's growth and progress have been achieved through the inter-working of exceptional natural and human resources in a system of free enterprise. The same factors will continue to add strength to our nation and its industrial fabric.

GOTTESMAN & COMPANY
— INCORPORATED —
100 PARK AVENUE • NEW YORK 17, N. Y.
EUROPEAN OFFICES: Birger Jarlsgatan 8, Stockholm, Sweden

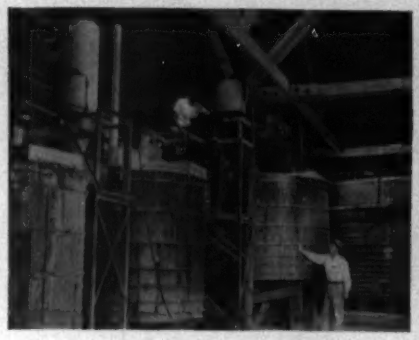
KAOLIN CLAY FACTS... *for Paper Makers*

NUMBER 7 OF A SERIES FROM THE J. M. HUBER CORPORATION

CLAY CONTENT OF PAPERS VARIES WIDELY

Clay content in uncoated papers ranges from 3-35%; generally, however, the average range is from 8-20%. In coated papers the figure depends on the clay content of the base paper, the weight of the coat and the percentage of clay in the coated surface. As a rule, the more dilute suspensions of coating formulations are used in the "brush" or "air-blade" processes, while machine coating requires highly concentrated mixtures. Typical illustrations are indicated in the table below:

Paper Type	Base Paper	Coating	Total Wt. of Paper	Total Wt. of Clay	Clay Sheet
Litho—coated one side	43 lbs/ream—5% clay (2.15 lbs)	17 lbs/ream—85% clay (14.45 lbs)	60 lbs/ream	16.60 lbs/ream	27.7%
Letter Press—Coated both sides	45 lbs/ream—9% clay (4.05 lbs)	12.5 lbs/side—90% pigment of which 75% is clay (8.44 lbs/side)	70 lbs/ream	20.93 lbs/ream	29.9%
Machine Coated Magazine Paper — Coated both sides	39 lbs/ream—11% clay (4.3 lbs)	8 lbs/side—85% clay (6.8 lbs/side)	55 lbs/ream	17.9 lbs/ream	32.6%



Introducing bleaching chemicals into water washed clay slurry at one of Huber's three clay plants.

The Bouyoucas Hydrometer shows the weight in grams of clay in suspension at any given time.

DETERMINING CLAY PARTICLE SIZE

There are various laboratory methods for determining the particle size of clays. All of them depend on sedimentation principles as expressed by a law of physics—Stokes' Law—dealing with the settling rates of small spherical bodies suspended in a fluid medium.

By taking readings of a clay-water mixture at regular intervals with a Bouyoucas hydrometer, the maximum diameter of particles in suspension at any given settling time can be determined from Stokes' Law. The table below is a typical illustration of apparent particle size diameters obtained with a Bouyoucas hydrometer after the time intervals shown at left. As one would expect, the larger, heavier particles settle out rapidly, while the fine, light particles remain in suspension much longer.

Have you received your copy of "Kaolin Clays and Their Industrial Uses"—new Huber 144-page technical reference book? Write on your company letterhead.

Dₐ Values in Particle Size Determination

Settling Time Minutes	Dₐ (Apparent particle diameter) Microns
1	78.43
5	35.07
10	24.80
40	12.40
150	6.40
500	3.50
1500	2.02
3000	1.43
4000	1.24
5000	1.11
6000	1.01
7000	0.94
8000	0.88

PARTICLE SIZE OF HUBER PAPER GRADE CLAYS

	Hi-White	Paragon	Washed Filler	Special Hydrates	Hydrates
Type	Filler	Filler	Filler	Coating	Coating
Particle Size (Microns)					
Above 5	12-15%	25-30%	28-32%	3-6%	6-8%
Under 2	63-66%	50-55%	47-52%	78-81%	70-72%

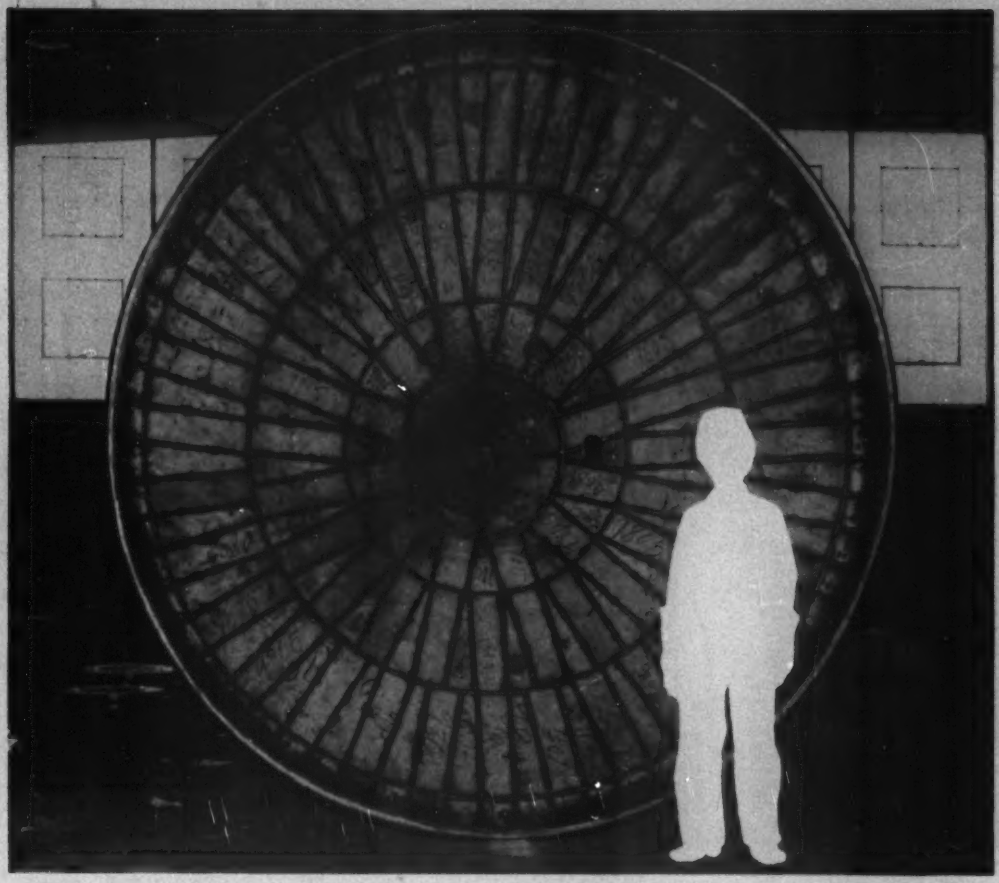
The above tables are condensed from the Huber *Kaolin Clays* book. Complete directions for determining particle size of clays will also be found in this volume.

HUBER

J. M. HUBER CORPORATION, *100 Park Avenue, New York 17, N. Y.*

MINES & PLANTS—LANGLEY, S. C., GRANITEVILLE, S. C., AND HUBER, GA.

ONE OF THE WORLDS'S LARGEST CLAY PRODUCERS



There's a welder in this picture . . .

We've drawn his outline in this picture just so you'd get the idea. But what we really mean to call attention to is his handiwork. The special anti-corrosive lining in the digester bottom shown here is the product of the welder's torch.

Supplying the pulp and paper industry with "custom-made" digesters and steel tanks with acid-resistant linings is a regular function of our shops. We're equipped to do x-raying and stress relieving too. Cylindrical and spherical pressure vessels, flat-bottom storage tanks, Marx Savealls, elevated water tanks—all belong on the list of products used in pulp and paper mills. For more details, or for quotations, write our nearest office.

Four pulp digesters, each 8 ft. in diam. by 31 ft. 8 in. are shown in this view leaving our Birmingham plant on the way to a pulp mill in Louisiana.

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Tulsa, 3.....1666 Hunt Building

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, and GREENVILLE

In Canada: HORTON STEEL WORKS, Limited, FORT ERIE, ONT.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

Where failures meant shutdowns they changed to grommet V belts

B. F. Goodrich grommet V belts cut costs 20 to 50%

THESE V belts operate in heavy-duty service 8 hours a day, 5 days a week. When the drive stops, the whole operation shuts down. It costs more to stop than keep going! Previous V belts suffered from shock loads, wore out fast. A BFG man recommended the grommet V belt to stand the jerks and hard pulls. The grommet V belts shown here have been in service 2 years, with no shut-offs or shut-downs for maintenance. Here's why the grommet V belt lasts 20 to 50% longer:

No cord ends—A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping ends. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless cord section in a grommet V belt eliminates such failures.

Concentrated cord strength—All of the cord material in a B. F. Goodrich grommet multiple-V belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. No layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced.

Better grip, less slip—Because a grommet is endless, a grommet V belt is more flexible, grips the pulleys better. Size for size, grommet multiple-V belts will give ⅓ more gripping power, pull heavier loads with a higher safety factor.

Only B. F. Goodrich has the grommet!—No other multiple-V belt is a grommet V belt (U. S. Patent No. 2,233,294). At present made in C, D and E sections only. See your local B. F. Goodrich distributor. Ask him to show you his "X-ray" belt that illustrates grommet construction clearly. *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Grommet V Belts BY

B.F.Goodrich

RUBBER FOR INDUSTRY

HENRY J. PERRY
Editor

Paper TRADE JOURNAL

R. S. THURSTON
Managing Editor

E. P. McGINN
Industrial Editor

E. P. NUTTALL
Associate Editor

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Secretary

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DATES TO REMEMBER

FEBRUARY 19-22: Technical Assn. of Pulp & Paper Industry, Annual Meeting, Hotel Commodore, N. Y. C.

FEBRUARY 19-22: American Paper & Pulp Assn., Annual Meeting, Waldorf-Astoria Hotel, N. Y. C.

FEBRUARY 21: Mass. Institute of Technology Alumni, Annual Luncheon in connection with TAPPI convention; 12:00 noon, Engineer's Club, N.Y.C.

FEBRUARY 21: New York State College of Forestry, Paper and Pulp Alumni: Annual Luncheon, Hendrick Hudson Room, Roosevelt Hotel, N. Y. C.

FEBRUARY 21: University of Maine, Paper and Pulp Alumni: Annual Meeting, Biltmore Hotel, N. Y. C.

FEBRUARY 19-22: Nat'l Council for Stream Improvement, Annual Meeting, Waldorf-Astoria, New York City.

FEBRUARY 20-22: 17th Products Show by Purchasing Agents Assn. of Chicago, Hotel Sherman, Chicago, Ill.

APRIL 17-20: American Management Assn., 20th Nat'l. Packaging Exposition, Auditorium, Atlantic City, N. J.

APRIL 30-MAY 4: Materials Handling Conference; Held concurrently with Nat'l. Materials Handling Expo., International Amphitheatre, Chicago, Ill.

NEXT WEEK

REPORT OF THE ANNUAL MEETING OF THE CANADIAN PULP & PAPER ASSOCIATION, HELD AT THE MOUNT ROYAL HOTEL, MONTREAL, QUE., JANUARY 24-26.

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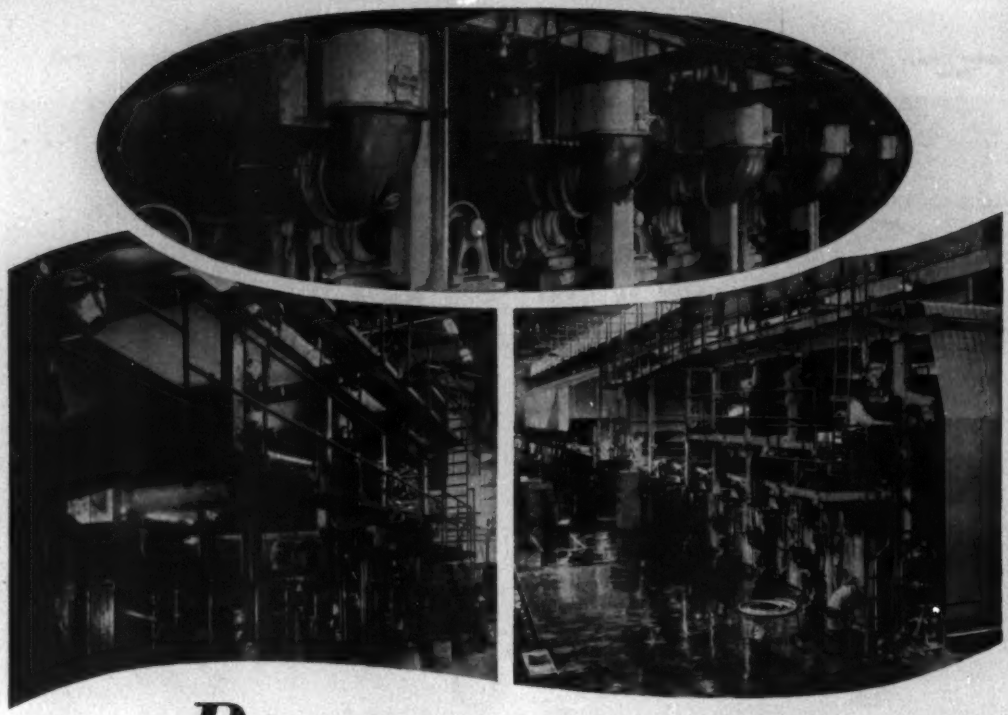

Recent B-C machines feature overhead presses

Two of several recent Black-Clawson machines featuring presses superimposed on vat section —one with B-C Hydronamic Inlets on liner vats only, the other with Inlets on all vats.

Black-Clawson, incidentally, holds the distinction of having been the first designer to: 1. build a cylinder machine wider than 100"; 2. develop the vertical dryer; 3. develop a more efficient way to deliver the stock to the mold by bringing out the B-C Hydronamic Inlet; 4. bring their engineering and shop practice to a truly high standard of precision and make possible substantially higher cylinder machine speeds.

If you are thinking of a new machine, Cylinder or Fourdrinier, Black-Clawson would appreciate an opportunity to consult with you and submit estimates.

BLACK-CLAWSON

HAMILTON, OHIO

Divisions: SHARTLE BROS. MACHINE CO., Middletown, Ohio
DILTS MACHINE WORKS, Fulton, New York
Western Sales Office: Mayer Bldg., Portland, Oregon
Southern Sales Office: 937 Coventry Road, Decatur, Ga.
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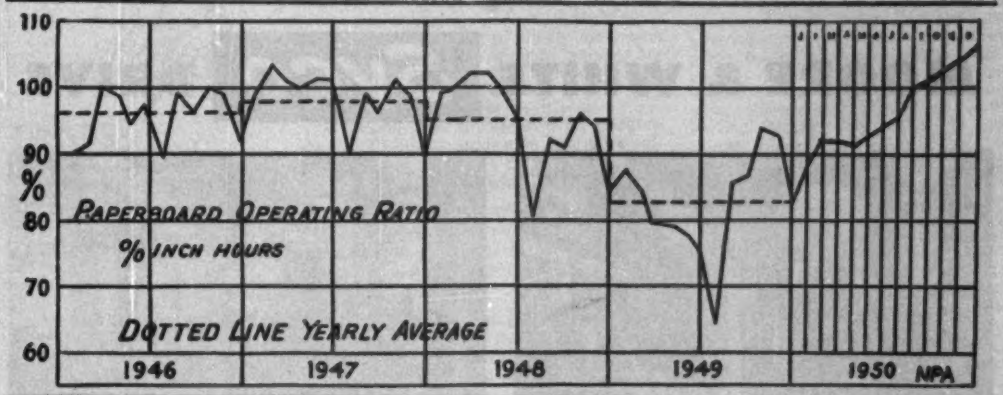
Subsidiary: B-C INTERNATIONAL, LTD., Greener House
66/68 Haymarket, London, S. W. 1, England



Weekly Brief of Important Figures

Source	Production	WEEK ENDING Jan. 13, '51[x]	Dec. 16, '50	Jan. 14, '50
APPA	Paper Production Percent Capacity	100.9	100.6	93.9
	Unbl. Kraft Paper Production Percent	98.3	98.9	89.8
NPA	Paperboard Operating Ratio Percent Inch Hours	106.0	105.0	94.0
		Nov. 1950	**Oct. 1950x**	**Nov. 1949**
APPA	Paper Production[a] (Except Newsprint and Building Papers) Tons	872,000	841,000	762,099
	New Orders Tons	831,000	836,000	754,993
	Unfilled Orders Tons	869,900	899,200	496,770
	Shipments Tons	872,000	850,000	755,367
		Dec. 1950	**Nov. 1950**	**Dec. 1949**
NPA	Paperboard Production Tons	862,905	1,168,958	827,400
	New Orders Tons	778,394	1,225,369	801,200
	Unfilled Orders Tons	617,245	722,046	359,300
	Our Customers Activities Index[1]	**Latest Mo.[c]**	**Previous Mo.[c]**	**Year Ago[c]**
FRS	Manufactures Total Index	228	225	179
	Durable Mfg. Index	262	254	176
	Nondurable Mfg. Index	201	201	181
	Chemical Products Index	280	272	245
	Mfg. Food Products Index	178	193	177
	Printing and Publishing Index	181	173	169
ODC	Magazine Advg.-Printer's Ink Index	342	338	294
	Retail Sales Combined Adjusted Index	323.3	332.3	294.4
	Drug Index	223.4	227.8	220.0
	General Merchandise Group Index	299.2	321.5	273.9
	Grocery and Combination Index	394.7	391.2	358.8
	Prices Index			
BLS	Consumers Price Index[1]	174.8	173.8	168.5
	Wholesale all Commodities[2]	169.1	169.5	152.2
	Wholesale Foods[2]	172.5	177.2	159.6
	Commodities other than Farm Products and Foods[2]	161.5	159.2	145.0
	Wholesale Pulp and Paper[2]	173.4	167.1	156.5
	Purchasing Power of Dollar, Consumers Prices[1]	47.8	48.0	49.9
	General Activity Index			
FRS	Mfg. Production-Worker Payroll	403.6	393.9	335.1
	Unemployment Compensation Initial Claims (M)	720	558	1,363
	Miscellaneous Carloadings–Thousands of Cars	1,673	1,963	1,277
	Electric Output (Million KW hr.)	34,307	32,650	28,169
PTJ	Average 32 P & P Common Stocks as of Jan. 16	$35.66	$33.51	$30.68
	Average Indicated Dividends Common Stocks as of Jan. 16	$ 2.39	$ 2.23	$ 2.30

[1] 1935-39=100 Unadjusted Index
[2] 1926=100
[a] New 6-7 day basis.
[b] For details see APPA Monthly Statistical Summary—November 1950 Estimated Figures
[c] Latest Month Available on Request
x Unrevised figures.

The improved
MOORE & WHITE *Syco* DRIVE

Photographs show a paper making set-up before and after installation of Moore & White Syco Drive. (Name of mill upon request.)

Primarily, this modern mechanical paper machine drive assures you:

- ***Increased production from your present paper machines***
- ***A more uniform, quality sheet at lower machine cost***

Scarcely less important are these vital profit and efficiency factors:

- ***A saving of up to 50 percent of usable floor space***
- ***Lowered power consumption***
- ***Sharply reduced maintenance costs***
- ***Greater safety to machine operators***
- ***Greater cleanliness that will promote good housekeeping***

Syco gives you a "clean" mill, free from overhead shafts, pulleys, idlers, countershafts and belts, guards for belts and gears, superstructure, ladders, and catwalks. There is no drive equipment above or below the floor level. Syco is easily installed and serviced by competent mechanics.

The compact Moore & White Syco Drive is simple in its expertly engineered design; precision-built and automatically lubricated for efficient, trouble-free, round-the-clock operation. It precisely synchronizes sectional speed, preserving uniform tension on the sheet at all times. Fingertip micro-adjustment insures uniform caliper, and the desired basis weight and finish throughout the run, at any selected setting. Breaks are fewer. Downtime is minimized. Wastage is cut way down.

Have a Moore & White sales engineer survey your installation and explain the greatly improved profit-potential of the Syco Drive in your operations. Your call involves no obligation.

The MOORE & WHITE Company

15TH STREET AND LEHIGH AVENUE • PHILADELPHIA 32, PA.

CUSTOM-BUILT MACHINES FOR MAKERS OF PAPER AND PAPERBOARD

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Paper TRADE JOURNAL

TRENDS

Office of the PAPER TRADE JOURNAL,
Wednesday, January 24, 1951.

It looks to many as though the last tortuous mile before price controls lies immediately ahead. Commentators are betting on an overall price freeze at January 1 levels within the week. Others place the date as February 1.

Speedy action is forecast with the acceptance of Eric Johnston as Economic Stabilization Administrator, replacing Alan Valentine resigned. And though Mr. Johnston stated that he had not made up his mind about the type of controls which were needed, Washington rumors were to the effect that a general price freeze would be quickly effected at January 1 levels and that adjustments by industries would be made as fast as machinery could be set up for enforcement.

To the paper and paperboard industries, as to all other segments of the general economy which are muddling along the road to inflation, price controls are inevitable. The stew which has been brewed out of current shortages and rocketing costs is getting too thick to swallow.

Black marketing may stalk along with price controls, it is conceded. It is the piracy of any emergency. Almost, however, it is held to be more desirable than the present confusion of inflated prices which one has either to bid up still higher to get supplies or go out of production. And all of this is private enterprise and within the law.

Paper merchants, waste paper and rag dealers report the situation a growing muddle on which they see no light but controls.

More Canadian Newsprint in 1951

Canadian producers will be able to supply the U. S. with 65,000 tons more than in 1950, R. M. Fowler, president of the Newsprint Association of Canada, said last week.

Speaking to the N. Y. State Publishers Association in Buffalo, Mr. Fowler said that Canadian mills will be able to supply 4,775,080 tons to the U. S. in 1951, about 15,000 tons more will come from U. S. mills, and that some 20,000 tons less will be available from Europe. In other words, U. S. consumers will be short 130,000 tons or 2.2 percent of the wanted 6,050,000 tons, an amount not held to be beyond the ingenuity of each publisher in the face of a national emergency.

The situation does not call for rationing, in Mr. Fowler's opinion. Any limitation order in the U. S. would work only if matched with controls in Canada, he said. International allocations to increase supplies to meet shortages in other friendly countries would result, thus reducing the available tonnages for U. S. publishers.

A similar loss of supply must come from any form of price control, Mr. Fowler stated. He expressed doubt that there could be price control without rationing, for to impose a fixed ceiling price would put many marginal mills out of production and move substantial quantities of European newsprint to other markets.

December Newsprint Statistics*

Production.—Canadian newsprint production in December amounted to 430,551 tons, an increase of 15,679 tons or 3.8 percent over December, 1949, an all-time high.

U. S. output of 87,780 tons was an increase of 19.9 percent over December, 1949. European imports of 17,400 tons were a gain of 43.9 percent over 1949's month.

Consumption.—Estimated U. S. consumption for December was 520,665 tons, a gain of 36,903 tons or 7.6 percent over December, 1949. About 79.4 percent of total U. S. supply came from Canadian mills, with about 17.1 percent from U. S. mills, and the remaining 3.5 percent from Europe. Total U. S. supply for the month was 500,210 tons, versus 467,450 tons in December, 1949.

Total estimated newsprint consumption for 1950 is 5,936,941 tons, a gain of 7.4 percent over 1949. Of this quantity, daily newspapers reporting to the ANPA used 4,541,760 tons, an increase of 6.7 percent over 1949's figure.

Fine Paper Shortages

The overall picture is an adequate supply of book, bond and other fine paper in the market. There is not an ample supply of all types everywhere it is wanted.

Sustained heavy buying is reported in the New York market, some of which does involve consumer shopping to find wanted lots, however. Dealers indicate that their allotments are sold up and that they find it difficult to maintain a normal inventory. Further cuts on mill allotments are a foregone conclusion because of pulp shortages, and many mills are months behind on shipments. Particularly is this true of sulfite papers. Offset is notably tight, as also is onionskin. Tag stock deliveries are badly crippled.

Though dealers speak of quoted prices meaning little these days, there has been little departure from announced prices since December. Exception comes from market-pulp consuming mills which are forced by shortages into the spot market. Rises of ½ cent a pound are reported, though higher prices are quoted by marginal mills which are buying pulp almost entirely in the premium market.

Soaring of prices for cotton cuttings is reflected in higher prices for rag content papers. Latest rise amounts to ½ cent a pound.

* Source: N.A.C., N.S.B., A.N.P.A.

Cottons Continue Rise

Acute shortages of papermaking grades of new cotton cuttings and growing mill demand are pushing prices up to unbelievable highs. Dealers tell of being unable to buy from long-time suppliers because of premium offers for their cuttings. Mills bidding higher and higher to get wanted quantities of white shirts, for instance, have propelled the dealer price from $10.75/$11 on July 1 to today's range of $19/$23, conservatively speaking.

Well-established brokers believe price controls must be initiated to stop the meteoric rise, though at what price level, in view of the premium prices heard, none is able to say. —E. P. N.

Materials

Chlorine.—Army plans for construction of a $15 million chlorine-caustic producing plant have been announced. Allocation of $5 million has been made to get construction underway. The plant, which will provide chlorine needed for the defense program, will be located near Muscle Shoals, Ala.

Caustic Soda.—A court order in the U. S. anti-trust case against two American and two British alkali export associations and 12 producers has ended cartel agreements in alkalis. The court held that the defendants had conspired to fix and stabilize the price of caustic soda, soda ash and bicarbonate of soda in the U. S.

Casein.—Active demand reported for domestic grades against light supply. Purchasing, however, restricted to immediate needs as buyers study economic situation. Argentine market reports active inquiry from European and U. S. buyers. Canada also seeking supplies. Production fairly heavy but not adequate to heavy demand. Prices firm.

Rosin.—Export controls expected in view of light supplies and requirements of defense program. European buying stimulated by possible rise in ocean freight rates. Increase in their own production not due before late May or early June. Domestic buying at Savannah reported cautious in anticipation of Government action. CCC sales for the week included 159 drums G, 367 H, 149 I, all for domestic distribution, at $8.50 per cwt.

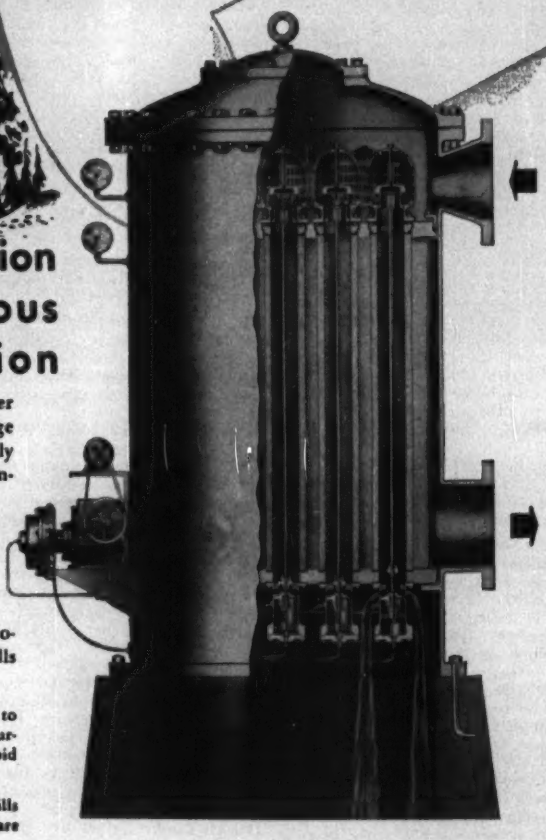
Soda Ash.—Major producer contemplates expansion to be completed within 18 months to two years from date of issuance of necessity certificate. Expansion would be at the producer's Louisiana plant and would provide 200,000 tons a year.—E. P. N.

Paperboard Production (Tons)*

	Jan. 13 1951	Jan. 6 1951	Jan. 14 1950
Production	241,472	207,870	207,624
New Orders	262,530	319,609	198,135
Unfilled Orders	746,287	727,579	388,173

* Source: NPA.

LESS DOWNTIME . .
MORE PAPER
with
ADAMS
AUTOMATICALLY FILTERED WATER



Continuous protection for your continuous machine operation

Higher production goals of today's faster machines must be protected—continuously. Large volumes of water, carrying proportionately larger amounts of impurities, need more attention than ever before.

Clean, automatically filtered water can eliminate down time due to plugged shower nozzles, helps avoid mid-week shutdowns for washing clogged felts.

Experience with Adams Poro-Screen and Poro-Stone Water Filters in pulp and paper mills from coast to coast has proved:

1. Continuous filtration can be relied upon to remove all objectionable impurities, even during seasonal conditions of highly turbid supply.
2. Production continues in Adams-equipped mills when others using the same water source are shut down for cleaning.

Write for your copy of the new 20 page booklet on water filtration in the Pulp and Paper Industry, Bulletin No. 691.

R. P. ADAMS COMPANY, INC.

231 EAST PARK DRIVE, BUFFALO 17, N. Y.

News of the Week

Paper TRADE JOURNAL

COLUMBIA CELLULOSE START-UP

February will see initial runs started at the new dissolving pulp plant of the Columbia Cellulose Co., Ltd., on Watson Island near Prince Rupert, B. C. Harold Blancke, president of the company, which is a subsidiary of the company, which is a subsidiary of the Celanese Corp. of America, reports that the plant will be completed by the end of January. He states that practically all major equipment has already been installed, and if it had not been for the delay in delivery of a few items of minor equipment start of the plant would have already commenced.

"Columbia Cellulose Co., Ltd., will come into production at a most propitious time," Mr. Blancke continued, "since dissolving pulp supplies at present are critically short. Principal consumers of pulp—manufacturers of acetate and viscose process yarns, acetate plastics, cellophane and explosives—have been feeling the pinch of reduced supplies, for some time. Moreover their requirements of cellulose are expected to increase as the defense program accelerates into high gear.

"The constantly growing demand for cellulose is demonstrated by the United States rayon industry which in 1950 delivered to consumers approximately 260 million more pounds of yarn than it did in 1949. Despite this record volume of shipments, the American industry was unable to satisfy completely the expanding market for its product, with the result that an additional 60 million pounds of rayon fibres were imported from abroad in the first nine months of 1950.

"Initial output of the Prince Rupert pulp mill will be at an annual rate of approximately 70,000 tons, the equivalent of a 20 percent increase in present supplies. It is possible that within a short time after operations get underway this production level will be lifted in a further effort to bring about a better balance of supply with demands.

PROPOSED CANADIAN MILL

Premier Pulp and Paper Co., Ltd., will build a $7 million ground wood and sulphite pulp mill near Sarnia, Ontario, according to Canadian Press dispatch. The pulp, in slush form, would be pumped through a pipeline to Port Huron, Mich., where it would be converted into 62,000 tons a year of catalogue and directory paper. Pulp enters the U. S. duty free whereas the finished catalogue and directory paper would be subject to a tax of 15 to 20 percent, according to the story.

PLAN JERSEY PAPER MILL

RIDGEFIELD PARK, N. J.—Members of the Board of Adjustment have announced that they will recommend that the Board of Commissioners grant a request to Eugene Werner of 443 Winthrop Road, Teaneck, to erect and operate a building for the manufacture of paper on meadow land between Route 6, Overpeck Creek and the New Jersey Turnpike.

PAPER MILL FOR MEXICO

It is reported that a $12 million newsprint paper mill will be built in Chihuahua State to manufacture paper from lumber industry waste products.

Mexico now buys most of her newsprint from Canada.

Private investors will supply half the necessary funds, with the Government providing the rest.

ST. REGIS BUYS LAND

PENSACOLA, Fla. — The St. Regis Paper Co. has contracted to purchase 20,000 acres of timber land in Baldwin County, Ala., for use in connection with its Pensacola paper making operations.

The property is located between the Styx and Perdido Rivers, near the Florida line.

The timberlands were acquired from the A. G. Crosby estate.

SEABOARD BUYS MOBILE INTEREST

MOBILE, Ala. — The Seaboard Container Corp. with main offices in Bristol, Pa., acquired title to a half interest in the former Mobile Paper Co. plant January 16. The Pennsylvania corporation bought the interest from the Stone Container Corp., with home offices in Chicago, for $544,000, according to reports.

OPERATE SOUTHWEST DIV.

The building program of the Southwest Division, United States Envelope Co., 10700 Harry Hines Blvd., Dallas, Texas, was finished right on schedule. Ground was broken July 15, 1950. Manufacturing operations started January 2, 1951.

Building is designed as Unit No. 1 of a possible future expansion program. This first unit, with all equipment, installed, represents an investment of approximately $1 million. The equipment is all new and of the latest design, much of it manufactured by the United States Envelope Co. in its own machine shops.

The manager of the Southwest Division is Evert M. Anderson, formerly of Springfield, Mass. Other personnel who went to Dallas under the direction of A. F. Duval, Sr., Pacific Coast general manager of the company, for the beginning of manufacturing operations are: G. J. Hadick, superintendent; B. B. Samborski, R. Sitzer, J. Anderson, A. Diguette, W. Deupree, Newman Samples.

The Southwest Division will serve the United States Envelope Co.'s customers in Texas, Oklahoma, New Mexico, Colorado, Arkansas and parts of Kansas, Missouri and Louisiana.

The new plant will manufacture a complete line of commercial envelopes, stationery, and paper drinking cups. It will be the fourteenth Division of the company.

PEAVEY MAKES NEWSPRINT

Peavey Paper Mills, Inc., Ladysmith, Wis., has contracted to produce 1,500 tons of newsprint for the Milwaukee (Wis.) Journal in the year beginning December 1, 1950.

The Journal sold its 40 percent interest in the mill, acquired in 1946, during November, 1950. The mill quit newsprint production June 30, 1949, at which time it had a capacity of 6,000 tons per year for newsprint.

FRANCONIA EXPANSION

Extensive improvements to better quality and increase capacity are now underway at the recently-formed Franconia Paper Corp.'s pulp and paper mills at Lincoln, which until recently were owned and operated by the Marcalus Manufacturing Co., Inc.

The first phase of this program has already started and involves installation of the chemipulp process for the sulphite mill. In order to provide ample room for this process, a large building adjoining the sulphite mill has been retaken and is now being renovated as the store house for all the mill's supplies and surplus equipment. This building will also house the offices of the resident manager, D. J. Walsh; the purchasing department under W. J. Canton, purchasing agent; and the timberland department under Henry C. Waldo, manager.

A large brick section forming part of the sulphite mill had previously been used for the storage of mill supplies. This section has been entirely cleared and will house the equipment of the new chemipulp process. Mill supplies now stored in several small frame buildings will be moved to the

new storage building and the small buildings will be demolished. Three railroad sidings run to the new storage building.

The old rotary sulphur burner and combustion chamber will be replaced by a new spray burner. Chemipulp spray coolers will be installed, with a two-system chemipulp adsorption system and a Roots-Connersville gas compressor — all completely automatic. There will be two five-plate all stainless steel absorption tanks, 24 feet high by four feet in diameter. The system is designed to handle 130 tons of sulphite pulp daily and it is expected that the installation will be completed within five or six months.

A new hot acid system with a 38-foot sphere has been ordered, all equipped with chrome nickel steel castings throughout with provisions made for circulation. Later it is planned to install another 15-ton digester in addition to the present three 10-ton digesters. This will increase pulp production about 50 tons per day.

A recently installed 12' x 45' Manitowac barking drum handles about 24 cords of wood per hour, replacing 14 knife barkers.

In an early formative stage are plans for replacements and improvements in the paper finishing department and the paper mill.

The paper mill of the Franconia corporation at Lincoln is equipped with three 133" — trim 123" Fourdriniers producing daily about 130 tons of sulphite bond, ledger and writing, coating stock, tablet, lace paper, manila folder, waxing, water repellent, groundwood writing and specialties; drinking cup, soda straw, printing manilas, white and manila envelope. In addition to the sulphite pulp mill at Lincoln, the corporation owns and operates a groundwood mill at Livermore Falls, 20 miles south of Lincoln, producing 35 tons of air dry groundwood per day.

Officers of the corporation are: President, Anthony Taccetta; vice-president, David Coleman; secretary-treasurer, Frank Messina; vice-president in charge of sales, Jack Somers. D. J. Walsh is resident manager; C. W. Stewart, general superintendent; Maurice J. Clark, technical superintendent; Archie Strickland, paper mill superintendent; William J. Canton, purchasing agent; Richard Osborn, plant engineer; Lawrence E. Smith, assistant plant engineer; R. B. Sawyer, finishing room superintendent; Henry C. Waldo, manager timberland department; John F. Walsh, personnel director; Glen Bassett, superintendent sawmill, and James L. MacDonald, office manager.

HAMMERMILL GETS CONTRACT

ERIE, Pa. — Hammermill Paper Co. will furnish the Army-Navy purchasing department with 50,000 reams of chemical wood mimeograph paper at a cost of nearly $50,000. The paper goes to the Navy bureau.

AT MICHIGAN DIVISION MEETING, SUPERINTENDENT'S ASSOCIATION

Dr. Arnold Schneider, guest speaker at the Dec. 21, 1950, meeting of the Michigan Division of the Superintendents Association (center); Harvey W. Hartman, American Box Board Co., Grand Rapids, Mich. (left); F. C. Goodwill, St. Regis Paper Co., Kalamazoo, Mich. (right).

DR. SCHNEIDER ADDRESSES SUPTS.

KALAMAZOO, Mich. — Dr. Arnold Schneider, professor and head, department of business studies, Western Michigan College, Kalamazoo, presented to 85 members and guests of the Michigan Division of The American Pulp and Paper Mill Superintendents Association, December 21, 1950, a most stimulating and helpful address on "The Supervisor and His Responsibilities to Men and Management."

According to Dr. Schneider, here are the very important responsibilities of supervisory personnel: *(1)* The supervisor must help to win the war with individuals he has at hand. *(2)* The supervisor must be ready, or get ready, to step in and help save our free way of living. (In the opinion of Dr. Schneider, the supervisor is the best person to do this job.) *(3)* The problem of the supervisor is to win a war with humanity at his disposal—management humanity and employee humanity. *(4)* The supervisor must be a salesman—he must sell ideas to the employees. *(5)* The supervisor, as a representative of management, must look like management, talk like management, and must act like management. Dr. Schneider also elucidated on the qualities of a good supervisor. He set up ten "musts" for a good supervisor. They follow:

1. He must evaluate himself. (He cannot transmit any better ideas than he possesses. He must be loyal to his firm, and must not belittle it in front of his employees.)

2. He must develop a philosophy or way of life.

3. He must develop a sense of humor —seeing things in their relative merit.

4. He must learn to be objective—must look at common things in new ways—must accept errors.

5. He must be a good teacher.

6. He must be a good organizer—must delegate duties.

7. He must not have neophobia (fear of the new).

8. He must be mentally alert (should read trade magazines—should be well-versed on business conditions and politics).

9. He must know company business and its problems.

10. He must be cognizant of the problems of other supervisory groups.

GARRETT BUCHANAN PARTY

The Garrett-Buchanan Co. held their annual dinner dance on January 12 at the Barclay Hotel, East Rittenhouse Square, Philadelphia. The employes from the Lancaster, Reading and Baltimore branches joined in this gala occasion. The entertainment was supplied by the various branches. The minstrel show consisting of a group of twenty-two entertained for an hour and thirty minutes. Their president, Morgan H. Thomas, could not be present. A message, however, was given to the employes through their program.

EMPIRE'S PARTY

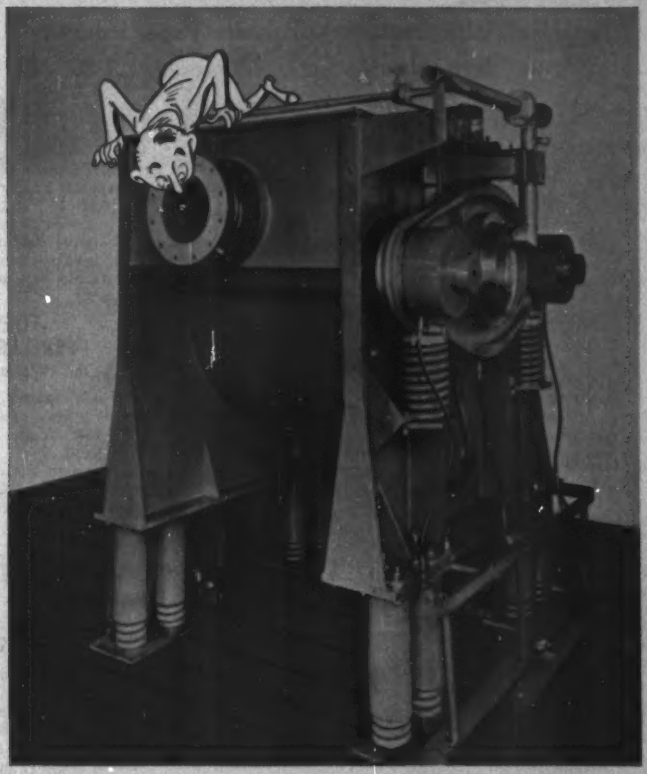
The thirteenth annual Christmas party given by Empire Box Corp., Garfield, N. J., was held December 16 at Belmont Park Auditorium in Garfield. Employes and their guests danced to the music of Jack Wehrlan and his orchestra. A buffet supper was served. Corsages of roses for women and butonnieres for men were distributed to all attending the affair.

Christmas bonus checks amounting to over $17,000 were distributed to 270 employes of the company. Empire Box Corp. initiated this bonus in 1936 and a similar bonus has been given to employes each year since that time.

In addition to operating a folding box plant in Garfield, Empire Box Corp. also has a paper mill in Stroudsburg, Pa., and another folding box plant in South Bend, Ind.

Empire Box Corp. is engaged in the manufacture of folding paper cartons and the popular 6 bottle take-home carriers.

BETTER LOOK INTO THIS...



BIRD *VIBROTOR* SCREEN

for high quality, high capacity screening of pulp

The Bird *Vibrotor* Screen combines vibration and rotation to produce 50 to 80 tons of well screened stock per day, at 1.3 to 1.5% consistency and ⅓ HP or less per ton. Quality of screened stock is uniformly excellent.

Back of the Bird *Vibrotor* Screen is seven years of successful operating experience covering over two hundred installations and handling sulphate and sulphite pulps and certain grades of paper and board.

Back of it also is Bird engineering supervision and service.

Better look into it!

BIRD MACHINE COMPANY

SOUTH WALPOLE • MASSACHUSETTS

Tentative Program For Annual Meeting

Technical Association of the Pulp and Paper Industry
Commodore Hotel, New York, N. Y., February 19-20, 1951

MONDAY, FEBRUARY 19, 1951

10:00 a.m. First General Session (East Ball Room)

A. E. Bachmann, president of TAPPI, Missisquoi Corp., Cheldon Springs, Vt., chairman.

1. Secretary's Report, by R. G. Macdonald.
2. President's Address, by A. E. Bachmann.
3. Report of Tellers Committee.
4. Report of Joint Text Book Committee, by J. N. Stephenson.
5. "Chemical Engineering Unit Operations in the Pulp and Paper Industry," by W. L. Badger, consulting chemical engineer, Ann Arbor, Mich.

2:00 p.m.—Committee Meetings (Grand Ball Room)

All committee meetings will be held in the Grand Ball Room unles otherwise indicated. Any member of the Association may attend any committee meeting. If you are not at present a member of a committee please introduce yourself to the chairman of the committee that interests you and in whose work you would like to participate.

Research Development Division (Grand Ball Room)

Fundamental Research Committee — H. F. Lewis, chairman.

Statistics Committee—T. A. Pascoe, chairman.

Microbiological Committee — R. F. De Long, chairman.

Patents Committee — Frank Makara, chairman.

Industrial Division (Grand Ball Room)

Vocational Education Committee — H. E. Lauer, chairman.

Nonfibrous Raw Materials Committee—E. N. Poor, chairman.

Water Committee—A. S. Erspamer, chairman.

Fibrous Agricultural Residues Committee—S. I. Aronovsky, chairman.

Structural Fibrous Raw Materials Testing Subcommittee—E. M. Jenkins, chairman.

Structural Fibrous Finished Products Testing Subcommittee — Emile Frederick, Jr., chairman.

Converting and Consuming Division (Room B-C)

Containers Committee—H. T. Barker, chairman.

Graphic Arts Committee—F. D. Elliott, chairman.

Coating Committee — J. H. Heuer, chairman.

Wet Strength Committee — K. W. Britt, chairman.

Resin Analysis Subcommittee—W. A. Schenk, chairman.

Cellulosic Materials Subcommittee — F. A. Simmonds, chairman.

Plastics in Paper Converting Subcommittee—R. T. Nazzaro, chairman.

Fabrication and Structural Products Subcommittee—C. J. Straka, chairman.

Plastics Committee (3:30 p.m.) — E. C. Jahn, chairman.

Pulp Manufacture Division (Grand Ball Room)

Alkaline Pulping Committee—Henry Vranian, chairman.

Mechanical Pulping Committee — F. W. O'Neil, chairman.

Chemical Products Committee — A. Pollak, chairman.

Pulp Purification Committee—W. D. Harrison, chairman.

Paper Manufacture Division (Grand Ball Room)

Preparation of Papermaking Materials Committee—J. J. Thomas, chairman.

Papermaking (Cylinder) Committee —J. J. Harrison, chairman (Room E).

Papermaking (Fourdrinier) Committee—N. R. Phillips, chairman.

Testing Division (West Ball Room)

Nonfibrous Materials Testing—J. P. Casey, chairman.

TAPPI-ASTM Joint Committee on Petroleum Wax—A. M. Heald, chairman.

Pulp Testing Committee—L. V. Forman, chairman.

Optical Properties Committee—A. H. Croup, chairman.

Microscopy Committee—C. E. Brandon, chairman.

Paper Testing Committee — A. K. Warner, chairman.

Packaging Materials Testing Committee—L. E. Simerl, chairman.

Chemical Methods Committee—A. S. O'Brien, chairman.

Container Testing — W. J. Balster, chairman (Room F).

Engineering Division (Room A)

Steam and Power Committee—C. J. Sibler, chairman.

Materials Handling Committee — A. P. Schnyder, chairman.

Drying and Ventilating Committee —M. L. Barker, chairman.

Engineering Research and Machine Design Committee — J. D. Lyall, chairman. (Also luncheon meeting 12:30 p.m. Room E.)

Mill Design and Economic Aspects Committee—R. A. Packard, chairman.

Hydraulics Committee—K. J. Mackenzie, chairman.

Mill Maintenance and Materials Committee—H. F. Parker, chairman.

Electrical Engineering Committee — A. S. Goodrich, chairman.

Chemical Engineering Committee — J. R. Lientz, chairman.

Data Sheets Committee—H. J. Perry, chairman.

TUESDAY, FEBRUARY 20, 1951

9:15 a.m. Water (Grand Ball Room)

A. S. Erspamer, P. H. Glatfelter Co., Spring Grove, Pa., chairman, Symposium on White Water and Waste Treatment.

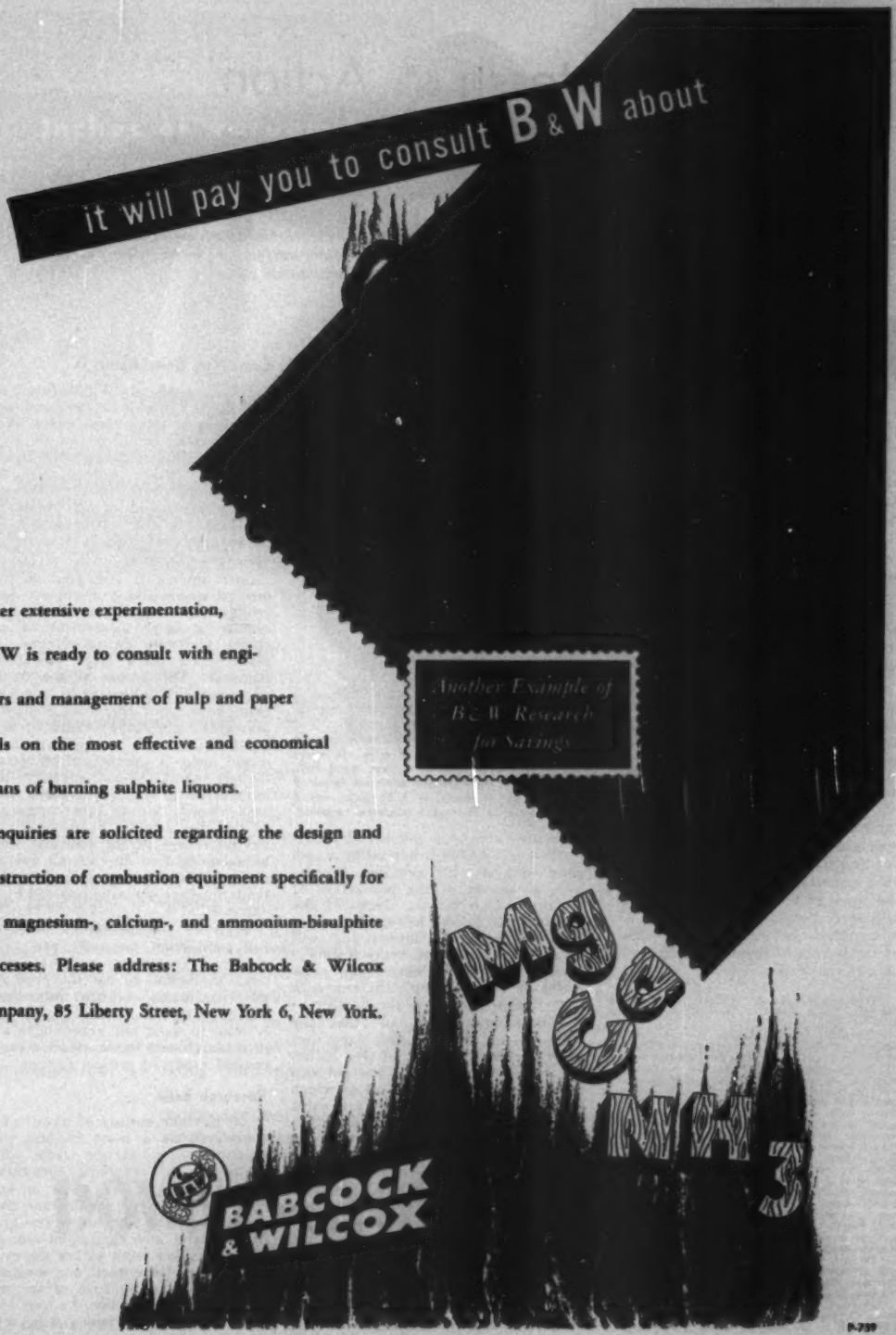
1. "Waste Water Disposal Program at Scott Paper Co.," by David R. Wadleigh, Scott Paper Co., Chester, Pa., and L. G. Simons, Chas. T. Main, Inc., Boston, Mass.
2. "The Bird-Gibbs Flotation Saveall," by Sven Fahlgren, Bird Machine Co., So. Walpole, Mass.
3. "Pennsylvania Standards for Water," by J. R. Hoffert, chief engineer, Commonwealth of Pennsylvania, Dept. of Health, Sanitary Water Board, Harrisburg, Pa.
4. "Experimental Chemical Treatments for Kraft Mill Waste," by William Moggio, National Council for Stream Improvement, New York, N. Y.
5. "Correlation of B.O.D. and Chemical Tests on Industrial Effluents," by K. G. Chesley, R. W. White, and R. V. Hogg, Jr., Crossett Paper Mills, Crossett, Ark.

9:15 a.m.—Structural Fibrous Materials (Room B-C)

John F. Campbell, Flintkote Co., Meridian, Miss., chairman.

1. "Light Reflection Measurements as Related to Decorative Insulation and Acoustical Products," by Richard S. Hunter, Henry A. Gardner Laboratory, Bethesda, Md.
2. "Preservation of Insulating Wallboard Against Decay and Insect Attack," by E. A. Behr, A. D. Chapman Co., Memphis, Tenn.
3. "Insulation Board Products and Their Relation to Various Building Codes," by Charles Gray, Insulation Board Institute, Chicago, Ill.
4. "Trends in the Insulation Board Industry," by J. O. Burton, Minnesota & Ontario Paper Co., International Falls, Minn.
5. "Flame-Resistant Surface Insulation Board and Methods of Test," by J. J. Perot, Whippany, N. J.
6. "Report on Insulation Board Institute Technical Committee Activities

(Continued on page 42)



After extensive experimentation, B&W is ready to consult with engineers and management of pulp and paper mills on the most effective and economical means of burning sulphite liquors.

Inquiries are solicited regarding the design and construction of combustion equipment specifically for the magnesium-, calcium-, and ammonium-bisulphite processes. Please address: The Babcock & Wilcox Company, 85 Liberty Street, New York 6, New York.

B-739

Sawteeth in Action*

L. H. REINEKE[1]

Studies of the cutting action of a single sawtooth led to the development of the Forest Products Laboratory Duo-Kerf rip saw. This experimental saw offers smoother surfaces, reduced power, increased accuracy, and reduced kerf over the conventional saw.

Introduction

The U. S. Forest Products Laboratory is dedicated not only to the better utilization of the lumber turned out by our sawmills and other wood-producing plants, but also to the better utilization of the logs produced in the forests by nature or by the efforts of our foresters. Much — too much — of the harvested trees appear as scrap in converting them into useful articles. Part of this scrap is forced on us by the round, tapering, irregular form of the raw material, about which little can be done immediately. The rest of this scrap is caused by machinery, about which something can be done.

The sawmill is our most talked-about scrap producer, but the directly visible slabs, sawdust, edgings, and trims that give it this prominence are not the only scrap the sawmill produces. Rough, inaccurately sawed lumber makes the user of rough lumber think of substitutes, or makes the planing mill groan to convert the excess thickness of poorly cut boards into shavings in order to make acceptable finished lumber. How important this can be is shown by the work of C. J. Telford, small sawmill specialist of the Laboratory, who has studied the variation in thickness of the boards produced at sample mills of different types.

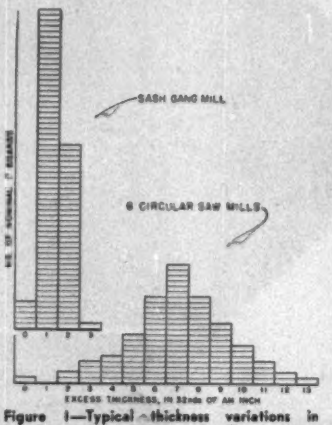


Figure 1—Typical thickness variations in boards cut by two types of mills. In every 100 boards produced by a sash gang mill, only 1 board exceeded the minimum required thickness by as much as 3/32 inch, and 5 boards were of the exact minimum required.

Figure 1 shows the number of boards by thickness classes produced by a sash gang mill and six portable circular mills in aiming at the production of nominal 1-inch boards. Now, if the thinnest boards, the left-most class in each graph, are the thinnest that will dress out to finish size, every thickness class to the right includes some excess material. If we multiply the excess in each thickness class by the number of boards in that class, and take the total, we find that the sash gang uses a total extra thickness of 4⅛ inches per hundred boards and the portable circular uses 22½ inches, all of which the planer has to make into low-value shavings, in addition to the minimum dressing required to clean up the boards. If, to these hidden scrap figures,[2] we add the kerf taken out by each mill (⅛ and 9/32 inch), the total scrap chargeable to sawing becomes 16⅜ inches per hundred boards for the sash mill and 50¼ inches for the portable mill, a ratio of 1 to 3. Considering both sawing inaccuracies and kerf, it becomes evident that the sawing operation is not uniformly at its best. What can be done about it?

Something Done About It

The Forest Products Laboratory has been doing research on saws and other cutting tools for several years. Work with portable mills has been separately reported.[3] Concurrently, investigations are being made of the basic relationships between the physical characteristics and strength properties of wood and the cutting action and mechanical forces involved with various types of cutting tools.

Such studies, if attempted on commercial woodworking machinery operating at normal production rates, would require a large assortment of machines, elaborate instrumentation, and consumption of a large amount of material. The forces at the cutting edges would be obscured by other machine forces and therefore difficult to segregate. The large volume of wood handled through modern machines would make it impractical to classify the test material by characteristics such as specific gravity, toughness, hardness, growth rate, or other properties, so that the changes in forces caused by differences in the material would be submerged in an over-all average, not particularly useful because tool limitations are normally imposed by the extremes.

Tests on commercial machinery in full production naturally are a desirable and necessary part of a thorough investigation, but the profitable, effective range of such tests should be predetermined by quicker, less costly tests to weed out unprofitable lines of research and focus attention on the critical range of critical factors.

Research Basis

All machine cutting of wood can be considered as a more or less rapid repetition of a cutting cycle. With headsaws and revolving cutterheads, the cut made by one tooth or knife constitutes the cycle; with some cross-cutting saws the sequence of one group of left-hand and right-hand side-cutting and raker teeth makes the cycle; in boring or lathe work, one revolution of the drill, or one turn of the stock or veneer bolt becomes the unit cycle. A study of the unit cutting cycle

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[1] Technologist, Forest Products Lab., Forest Service, U. S. Dept. of Agriculture, Madison, Wis.

* Presented at the Fourth Annual National Meeting of the Forest Products Research Society at Portland, Ore., June 26th-28th, 1950.

[2] By reducing the circular saw set-over for each cut by $\frac{1}{32}$ inch, the three thinnest boards will be undersize and perhaps only partially usable, but the $\frac{1}{32}$-inch sawing on each of the 100 boards will save 9⅜ inches of material from which an additional 6¾ boards per 100 (including their kerf) could be cut. Trading better than 6 boards per 100 for 3 partial or even complete rejects would seem to be good business. With the sash-gang saw, a reduction in saw spacing of $\frac{1}{32}$ inch would yield a net gain of 1⅜ boards per 100 provided the resulting 3 undersize boards were dressed and marketed as ¾-inch boards, or were thick enough over 75 per cent of their length to make shorter 1-inch boards. Rejects might find use around the mill for construction or lumber pile roofs.

[3] Telford, C. J., and L. H. Reineke, "Investigation of Energy Requirements for Inserted-Point Circular Headsaws," American Society of Mechanical Engineers, 70: 11, p. 913, Nov. 1948.

Telford, C. J., "Energy Requirements of Inserted-Point Circular Headsaws," Southern Lumberman, 178: 2235, p. 42, May 15, 1949.

Intelligent placing of Downingtown Suction Rolls in paper and board machines results in the advantages above *without* additional power on the drives. The cost of the additional power required by the vacuum pump is negligible when compared with the ultimate savings in production costs and maintenance and improvement of product quality.

Downingtown, a pioneer in the development and application of suction rolls, has long played an important part in converting paper mills to this modern method of water removal. Whether one or more suction rolls will improve your mill production can be determined quickly through surveys of your plant by Downingtown Engineers. The cost of modernization and improvements are surprisingly low, the savings surprisingly high.

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should, therefore, disclose a typical pattern that is repeated in succeeding cycles.

With a full understanding of the action during one cycle, the aggregate effect of numerous repetitions is largely a matter of multiplication. Under some operating conditions, however, one cycle may affect succeeding cycles, as in saw dodging. Operational factors, such as the tool temperatures attained under continuous cutting, may affect the pattern of cutting action somewhat. The effect of repetition, however, is more readily analyzed if the independent cycle is known. This fact, plus the reduction of experimental error by accurate knowledge and control of the small amount of test material needed, makes the single-cycle approach very attractive.

Research Equipment

The method to be chosen for studying the action during single cuts or sequences had to combine sensitivity and accuracy with ready adaptability to a wide range of operating conditions, including speed, feed, cutting radius, tool and material positions, tool forms, wood species, grain direction, hardness, and other characteristics.

These requirements for a testing machine or dynamometer seemed most likely to be met by utilizing the principle of the pendulum. If a frictionless pendulum is released from a given height, it will swing to that same height on the opposite side. This free-swing height will be reduced if the swing is obstructed, as by placing a piece of wood in the path of a cutting tool attached to the pendulum. The difference between free-swing height and obstructed-swing height represents the energy absorbed from the pendulum by the obstruction. The mathematical, structural, and operating simplicity of the pendulum made it the logical choice, and design of the testing equipment was accordingly based on this principle.

Figure 2—Pendulum dynamometer developed for cutting tests. Tool holder is mounted on right-hand pendulum and specimen holder on the left. Motor drives roller chains that carry recording styluses across drums at constant speed. Tape attached to each drum shows maximum angle reached by pendulum on its forward cutting swing.

The completed dynamometer is shown in *Figure 2*. Essentially, the final design incorporates a pair of slanting end posts supporting an arch, from the center of which hang two thin-wall tubular pendulums, large in diameter to prevent torque deflections, hollow to receive weights adjustable in size and position to vary the energy or velocity. A tool holder is mounted on one pendulum, and a specimen holder, with micrometer feed device, on the other. The bearing shaft of each pendulum extends beyond the outer bearing and

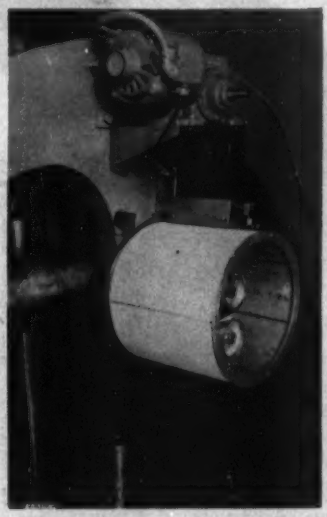


Figure 3—Recording and calibrating drum of dynamometer, with calibrating weight suspended by wire around grooved inner end of drum. Control knobs on panel are for adjustment of voltage passed through electrosensitive recording paper by styluses carried by motor-driven chain.

supports a two-step drum *(Figure 3)*, the smaller one being very narrow and serving, with the wire-supported weight, as a calibrating drum, whereas the larger drum is wide enough to carry a strip of electrosensitive recording paper 10 inches wide. A set of styluses, carried by a chain driven at constant speed, moves along a straight line parallel to the pendulum shaft.

Rotation of the drum under the stylus produces a trace showing the angular position of the pendulum in relation to time. This trace is sinusoidal when the pendulum swings freely. When 60-cycle alternating current is passed through the stylus, the trace is interrupted 120 times per second, producing dashes of a length proportional to velocity. Thus, velocities shown by the slope of the trace can be checked by time measurements, or the duration of a specific portion of the trace can be determined by count of the breaks

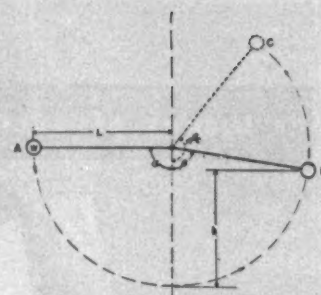


Figure 4—The principle of the pendulum. If the pendulum starts from A, its energy at the bottom of the swing is sufficient to lift its weight W to terminal position B, equivalent to a vertical lift h.

in the trace. By this graph, changes in velocity in different portions of the sample, such as knots or areas of distorted grain, can be measured. When a complete record of the test is not needed, a tape graduated in degrees is attached at one end to the drum and passes through a fixed index that holds the tape at the point of maximum swing.

Operation of Test Equipment

Calibration of the machine, performance of the test, and calculation of the energy consumed in the test are in reality simple operations. The wood specimen to be used (up to 2 inches in thickness) is clamped in the specimen holder, varying the position of the holder or the direction of the grain in the specimen to permit the cutting tool to cut at the desired angle to the grain. The tool (a saw tooth or set of teeth, a straight or formed shaper blade, or other cutting edge) is placed in the tool holder in position to cut as desired, either on an inside radius as in sawing, an outside radius as in rotary veneer cutting, or in a plane as in slicing or stationary-blade planing. Both holders are clamped to their pendulum columns at positions that give the required cutting radius, but with the specimen retracted enough to be cleared by the tool. Extra weights, if needed, are placed within the columns at the desired distance from the center of rotation. The tool-carrying pendulum is raised to the desired height, and the slack in the maximum-swing tape is taken out by pulling the tape through the index. The pendulum is then released, rotation of the attached drum drawing the tape through the index until the maximum height is reached at the completion of the forward swing. The tape, which remains in position during the back swing, indicates the angle of free swing corresponding to the initial swing.

For calibration, the pendulum is again raised to the starting position and a calibration weight of 5 or 10 pounds is suspended from a steel piano wire fastened in the groove of the narrow calibration drum so that the

weight is on the side away from the pendulum end and will be lifted as the pendulum swings forward.[4] After setting the maximum-angle tape and reading the initial angle (α), the pendulum is released. The maximum angle reached, (β), will be less than that in the free swing because of retardation due to the energy absorbed in lifting the calibration weight. The energy absorbed is the calibration weight (w) multiplied by the circumference (C) of the calibration drum which is multiplied in turn by the portion of a complete revolution the total swing of the pendumlum represents, or

$$\text{Calibration weight energy} = w \times C \times \frac{\alpha + \beta}{360}$$

In *Figure 4*, the simple pendulum released from position A has swung to a slightly lower position B on the other side because of slight bearing friction and air resistance. The energy at the bottom of the forward swing is sufficient to raise the pendulum weight w to a height h. In foot-pounds this energy equals h (in feet) times w (in pounds). Height h is readily computed as 1 minus the cosine of the angle β, times L, the pendulum length. (When angles above the horizontal are involved, as in pendulum position C, h is similarly $[1 - \cos (180 - \beta_c)]$ L, if $\cos (180 - \beta_c)$ is considered negative and subtracted algebraically.) The length L would be difficult to determine for the many combinations of weights and positions of the actual pendulum used, but need not be known. Since $h = L (1 - \cos \beta)$, energy equals $wL (1 - \cos \beta)$. The term wL is constant for a given setup. In the free swing and calibration swing

$$\frac{\text{Pendulum energy}}{\text{Pendulum energy} - \text{calibration weight energy}} = \frac{wL(1 - \cos \beta_1)}{wL(1 - \cos \beta_1) - wL(1 - \cos \beta_2)}$$

where β_1 is the free-swing maximum angle and β_2 is the maximum angle with the calibration weight. Clearing and transposing, this equation becomes

$$\text{Pendulum energy} = \frac{\text{Pendulum energy} - \text{calibration weight energy}}{(1 - \cos \beta_1) - (1 - \cos \beta_2)}$$

For a given initial angle and pendulum setup, $\frac{\text{Pendulum energy} - \text{calibration weight energy}}{(1 - \cos \beta_2)}$ is constant, and can be denoted by k, hence, for any terminal angle β, the pendulum energy is $k(1 - \cos \beta)$.

The calibration for the specimen-bearing pendulum can be made in the same way if it is to be used in either a free-hanging or a counter-swinging fashion, but need not be made if the pendulum is locked. Recalibration is necessary only if the weight distribution of the pendulum is changed.

In preparation for the actual cutting tests, the wood specimen may be precut to conform to the cutting path

[4] If the calibration weight is suspended on the opposite side of the drum, it will add to the energy of the pendulum. Either method is acceptable.

Figure 5—Strobosccopic type of photo of single insert-type sawtooth, carried by the tool-holding pendulum, swinging into wood sample mounted in the specimen holder on the other pendulum.

of the tool, or the specimen may be gradually advanced toward the tool, between swings of the tool pendulum, by the micrometer feed screw, light cuts being taken until the cut includes the full cutting arc across the entire specimen. Thus prepared, the tool pendulum is raised to its release height, the specimen is advanced the desired amount by the micrometer feed, and the maximum-angle tapes are drawn

Figure 6—An insert-type sawtooth sharpened to a mirror finish reflects the lines and fibers of graph paper on which it lies. The actual cutting edge is invisible, but lies along the central vertical line at the points of the inverted V's in the horizontal lines.

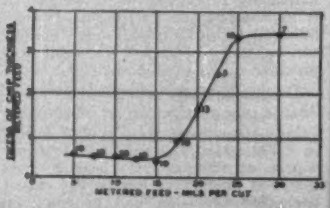


Figure 7—The measured thicknesses of chips cut at various feed rates exceed the metered feeds by amounts that vary with slippage of chip segments along the transverse shear lines. At feeds of less than 15 mils, excess thickness is due to surface roughness; above 30 mils the chips fall apart into sawdust as they are pried loose by the tooth face.

up. The tool pendulum is then released to make the cut, as shown in *Figure 5*, and caught on the backswing, and locked at release height for the next cut. The maximum angles reached by both pendulums are recorded, the specimen advanced, tapes reset, and the tool pendulum released. This sequence is repeated as often as necessary to obtain the number of measurements needed for averages or comparative values than are statistically reliable.

Capacity of Test Equipment

The available ranges of test feeds, speeds, and energy input are wide. One graduation of the feed screw corresponds to a feed of 2.5 mils (0.0025 inch) and feed may range upward from this amount to a quarter inch or more. Cutting speeds can be regulated from a high of 2,500 feet per minute (without speed-raising accessories) down to the essentially static conditions resulting when the specimen pendulum is pulled slowly forward against the tool, the tool pendulum applying

Figure 8—Chip breakage becomes increasingly severe as feed rate increases from 2.5 mils (A) to 50 mils (E).

increasing force, due to its weight, as it approaches the horizontal. Several hundred pounds of additional weights can be used to increase the static tool pressure or its kinetic energy.

Despite the wide range in test conditions, the dynamometer free-swing values are consistent to within 1 part in 4,000. Air resistance is the major source of friction loss; bearing friction was made very low by the use of preloaded precision ball bearings on the outer ends of the shafts, and by supporting the inner end of one shaft on needle bearings within the end of the other shaft, which in turn is supported by needle bearings mounted in the frame. That bearing friction is low is shown by the fact that, with the pendulum hanging free, a single hair stretched out and pulled against a razor-sharp tool edge will cause a small deflection of the pendulum before the hair is cut through.

This high sensitivity means that all the small variations in specimens and in the action of the cutting edges will be reflected in the readings of the dynamometer. Each test series must be designed to segregate the effects of variations in the sample from the variations in cutting action. This is not difficult; it merely requires that the design of the experiment be carefully worked out.

Scope of Information

The first few tests with the dynamometer showed that information aplenty could be had—and would be needed—for a full understanding of the cutting action of even one type of tool. Because of the importance of saws to the forest products industries, the swaged sawtooth was chosen as the first tool for study.

The action of cutting tools is dependent to some extent on the keenness of the cutting edge. Initial sharpness may vary widely, and dulling begins as soon as the tool goes into use. A measure of sharpness obviously was needed to permit separation of the effects of keenness from the effects of other variables, such as cutter form and speed, rate of feed, and resistance of the wood. A uniform material that would not injure a fine edge might be used to measure sharpness in terms of the energy required to cut a unit area of the material.

A readily available material, uniform and reproducible, is 50-50 solder. A bar of this solder was tested as a sharpness indicator with good results, after early irregularities were cleared up. The first tests of energy consumed in cutting the solder, in relation to thickness of chip (feed rate), resulted in a more or less straight-line graph, but with far greater variation of individual values than expected. The feed mechanism was suspected of irregularities, and so a micrometer was used on the solder chips after uncurling them. Measured thicknesses were quite different from the intended feed rates, but when energy consumed was plotted over measured thickness the resulting graph was less linear and no better defined than before.

Critical examination of the solder chips showed that they were much shorter than the length of the cut area on the solder bar. This shortening became more noticeable as feed rate increased; obviously, the solder tended to cold-flow as a result of pressure by the sawtooth, and this flow thickened the chips, since expansion in width was prevented by adjacent stock. With this knowledge, it was evident that chip weight was necessary to check or determine feed rate. Variation in feed was then traced to difficulties in clamping the narrow, taper-sided, embossed-top solder bar. By plotting energy in relation to weight of chip, the variations in feed from clamping irregularities were neutralized, and the graph relating energy consumption to chip weight was a perfectly straight line of positive slope, extremely well-defined, with a correlation coefficient of 0.99754 ± 0.0024. Unhappily, however, the line

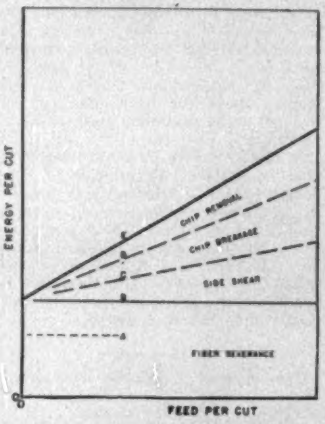
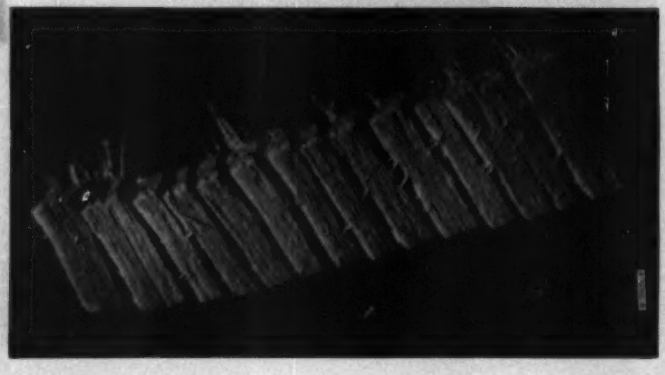


Figure 10—Top Sawtooth action duplicates the four manual steps in grooving. Bottom. Generalized relation of total energy used in sawing (Curve E) to feed rate. Distribution of energy between the four steps indicated by Curves B, C, and D for a somewhat dull sawtooth. Resharpening reduces fiber severance, lowering curves to position A.

Figure 9—This thick chip has broken along transverse shear planes, but a few fibers continue to hold the pieces together in a tipped position.



passed above the origin, thus showing some energy consumption at zero feed and suggesting, at the time, some experimental failure.

The insert-type sawtooth used with the solder tests had been lapped and polished to a mirror finish (*Figure 6*), to achieve an edge of maximum sharpness. Such keenness would be impractical in ordinary usage, but served as a reproducible starting point for studying the progression of dulling. This extremely sharp tooth was then used to cut dry sugar maple across the end grain, with a metered feed increasing from 2.5 mils (0.0025 inch) to 100 mils (0.100 inch). Since wood could not be expected to cold-flow under cutting pressure, micrometer measurements of chip thickness were made in preference to taking chip weight as a check on uniformity of feed.

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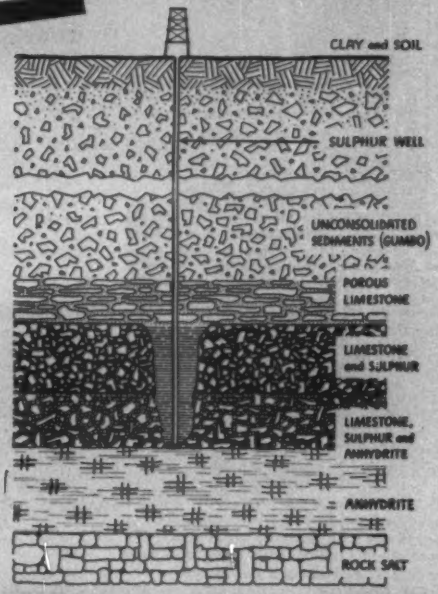

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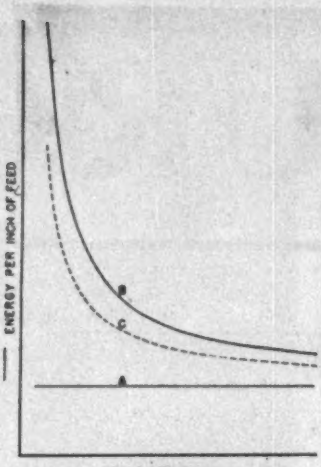

Figure 11—Chip loosening, break-up, and removal require a uniform amount of energy per inch of sawline (A), but fiber severance raises the total energy required per inch of sawline (B) to high values at slow feeds because more cuts per inch are made. Sharper teeth will reduce the total energy to (C), but the finer feeds will still require the greater energy.

Measured thicknesses for the various feed rates used were very consistent from cut to cut, but did not tally exactly with the metered or feed-screw values, always exceeding them. To locate the cause, the excess in thickness was plotted over metered feed (*Figure 7*), in which the excess in thickness is practically a uniform half mil for feeds up to 15 mils, and 4.5 mils for feeds over 25 mils, up to 30 mils, the maximum feed at which the chip held together well enough to measure. The total depth of cut measured on the stock checked with the sum of all the metered feeds, thus verifying the feed-screw accuracy but posing the question of why the separate chips should measure more than the feed rate. For the feeds of 15 mils or under, the very slight excess could be attributed to a slight roughening of the cut surfaces, but some other factor must be responsible for the sudden and appreciable rise between the 15 and 25 mil rates. The answer was found in the process of chip breakup.

In *Figure 8*, A is a chip 0.0025 inch thick, the thickness of a hair. It curls naturally under its own weight; it is a continuous, unbroken ribbon. Chip B is 0.0075 inch thick, and, although it is a continuous ribbon, it is somewhat stiffer than chip A and does not curl. Chip C is 0.0125 inch thick, fairly stiff, and shows some fractures and a few complete breaks due to bending by the face of the tooth or in the gullet. Chip D, 0.020 inch thick, broke completely quite a few times. The breaks become more numerous as the chip becomes thicker, until at a feed of 0.050 inch all semblance of a ribbon is lost and the chip comes from the gullet as typical sawdust (E).

Here, in the breaking up of the ribbon, is the explanation of the excess chip thickness. As the chip becomes too thick to bend over the tooth face, it tends to shear along the grain in planes that are crosswise to the direction of cut. At the minimum thickness at which these shear planes develop, the adjacent pieces are not permanently displaced, but as the thickness increases the front piece at a shear plane slides upward over the following piece, with partial rupture of attacked fibers. As a result, the successive partly detached pieces acquire a displaced and partially tipped position in the ribbon-like chip, as shown by the side view of a very thick chip in *Figure 9*. This slippage and tilting increase the distance between the high spots on top and bottom surfaces, resulting in an apparent increase in thickness. The maximum excess thickness is reached

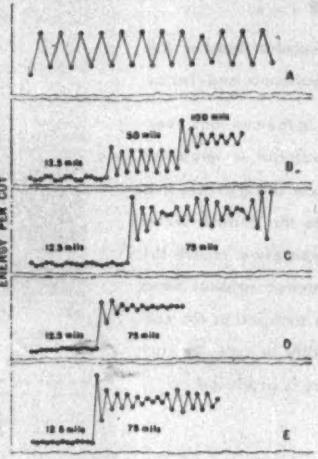

Figure 12—The cut made by one sawtooth may have an influence on the amount of energy required by the following tooth. High and low energies may alternate uniformly (curve A), or may follow several cyclical patterns (curves B to E), depending on the kind and condition of wood, tooth form and sharpness, and feed rate.

at the point where the fibers holding the pieces together are too few or weak to hold the pieces in a more fanned-out position. Beyond this point, fiber detachment at the shear planes becomes complete and a granulated chip results.

The process by which chips, or sawdust, are formed in ripping is vaguely suggested by the progressive change in chip as feed increases. Because of the high speed at which a saw tooth performs its duties, the details of its action are invisible.

Seemingly, the action is complex, but the complexity is that which results when several actions occur in unison or in quick succession. When the actions are taken separately, each one is merely the equivalent of a common, everyday kind of manual operation.

There are four principal actions working in the kerf in perfect coordination, each doing one of the four parts of the job. In the first, work is exerted to sever the fibers along the bottom of the chip-to-be with a very thin cutting edge. In the second step, the severed chip is pried loose from the sides of the cut, shearing the side fibers and incidentally meeting resistance from cross grain along the near side. In the third, the loosened chip is broken into small bits, so that, in the last action, the pieces of broken chip can be removed from the tight-fitting kerf.

At maximum feed rates, especially in dense or frozen wood, these four sawing actions may run into trouble. The cutting edge may dull quickly. In prying the chip loose the tool may bend, or even break off. The thick chip of dense wood will resist breakup, strongly, and may cause excessive friction and abrasion on some part of the tooth. As the broken-up chip is pulled ahead by the gullet, the resistance to chip removal places a stress on the tooth, a stress that is released—and released abruptly—at the instant the tooth and sawdust leave the kerf.

These four actions provide all the energy required to make the saw cut—including some energy in the form of heat resulting from internal friction in the wood or friction between the stock and the tool or sawdust. The division of this labor between the four actions is not always equitable. The job of fiber severing is monotonously regular regardless of feed rate, because, whether the chip be thick or thin, the same number of fibers must be severed at a constant energy input, at the level A in Fig. 10, if the cutting tool is unusually sharp, or at some

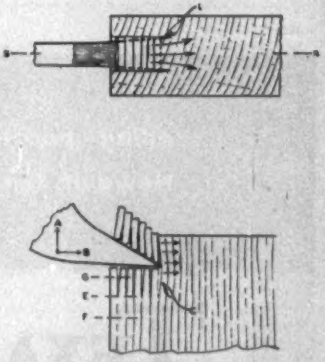

Figure 13—Force applied to wood by sloping front or face of sawtooth has radially acting component A, which removes the chip and tangentially acting component B, produces the pressure indicated by arrows in both top and side views. This pressure may produce small splits (D) along the kerf walls, slightly ahead of the cutting edge, but more severe splits (C) may extend as much as ¼ inch ahead of sawtooth cutting path. The energy required by the following tooth depends on whether cutting line is at E, F, or G.

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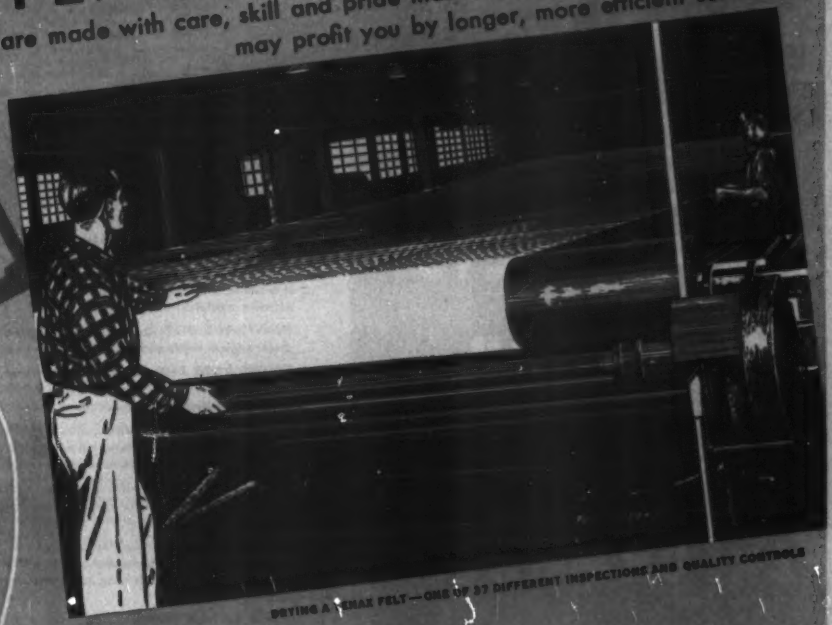

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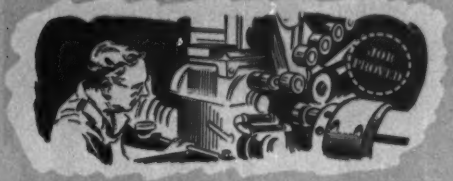

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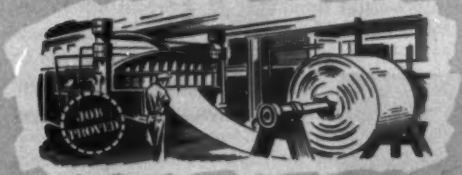

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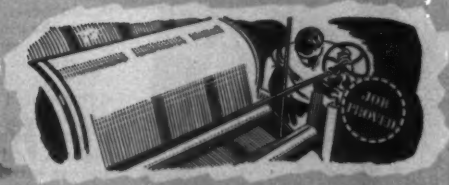

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higher level B if duller. The other action of this coordinated team work hard or take it easy, depending on the feed rate. When the feed is slow, the chip is thin and easily pried loose, broken up and cleaned out of the kerf. When the feed doubles, the chip is twice as thick and twice as hard to pry loose, break up and clean out.

The energy per cut expended in prying the chip loose is added to the severance energy curve B to give curve C. Likewise, the energy in breaking up the chip, when added to curve C, gives curve D, and finally, the addition of the clean-out energy to curve D completes the summation with curve E.

The proportionment of total energy between the four actions is contingent on many factors. Besides tool sharpness, fiber severance energy will vary with moisture content, species, hardness or density, and strength of the wood. The shear strength that resists breaking the chip loose varies with species and moisture content, and the resistance will also vary with direction of grain. The energy expended in breaking up the chip will vary with shear strength of the species, moisture content, and frequency of breaks across the chip, this latter varying inversely with hook angle. Finally, the energy for chip removal will depend on the roughness of the kerf walls, the hardness of the wood, and the amount of deformation and cross grain in the wood that may cause the chips to bind in the kerf.

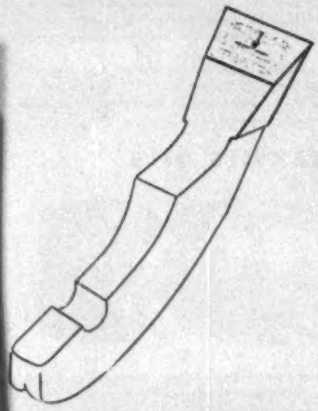

Figure 14—How a swage-set sawtooth wears. Shaded area on tooth face indicates test coating not worn off during use under light feed conditions. Under heavy feed conditions, the boundary of coating that parallels the cutting edge recedes to a new position, indicated by the arrow.

The numerous combinations of conditions possible will result in variation of the slope and general elevation of curve E of *Figure 10*, which indicates the general relationship between total energy and feed per tooth. This curve crosses the zero feed line at a positive value, which may be low if the cutting edge is sharp (curve A), or higher as the cutting edge dulls (curve B), the series of curves moving bodily upward since the prying, breaking, and cleanout energies are independent of fiber severance energy. The zero-feed value of the total-energy curve E thus indicates initial sharpness and changes in sharpness, and in the tests with solder, the graph that 'unhappily passed above the origin' actually was indicating the force required to sever the solder, as distinguished from the energy required to free, curl, and deform the chip.

The effect of sharpness and feed per tooth on total energy per inch of saw line can be deduced from curves A, B, and E, of Fig. 10. Excluding fiber severance, the energy per cut for a given feed rate is curve E minus curve B. If this difference at various feed rates is multiplied by the number of cuts per inch, horizontal curve A of *Figure 11* can be plotted, showing that the three phases of the operation involved are a constant for a unit length of saw

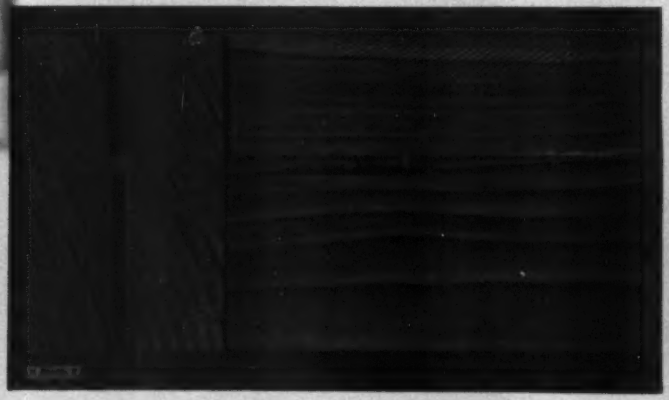

Figure 15—Comparison of cutting by conventional and Duo-Kerf circular sawtooth, lower surface and kerf produced by Duo-Kerf bench saw; upper surface and kerf by a conventional swaged-tooth saw of same gage and diameter.

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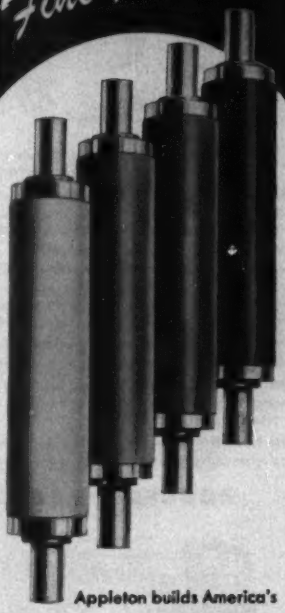

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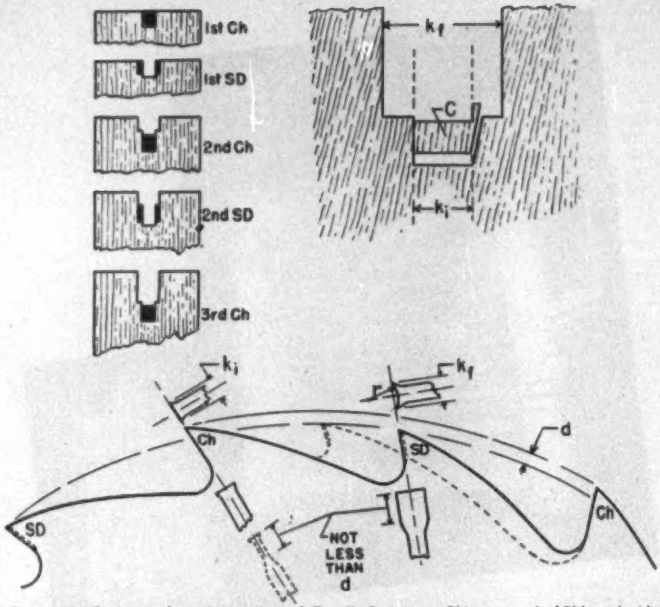

Figure 16—Design and cutting action of Duo-Kerf ripsaw. Chipper teeth (Ch) and side-dresser teeth (SD) may have like or unlike gullets, as indicated by solid and broken-line profiles in lower sketch. Side-dresser teeth have parallel sides and concave face, and are lower than chipper teeth by d, which is related to feed rate. Upper left, material removed in sequence of cutting actions by chipper and side-dresser teeth. Upper right, chipper-tooth chip lifted partly from initial kerf (k_i) after being sheared from kerf walls in wood with sloping grain. Note that run-out of grain at right side of chip ended in bottom of final kerf (k_f) instead of tearing into kerf wall.

line (or unit area of sawed face), even though the work per cut varies. Since fiber-severance energy is constant for each cut, regardless of feed rate, the severance energy per inch of saw line is the number of cuts per inch (1 divided by feed rate) multiplied by the severance energy per cut shown by curve B of Fig. 10. By adding the severance energy per inch of saw line at different feed rates to curve A of Fig. 11, total-energy curve B can be plotted, showing a rapid decrease as the feed per tooth increases. By sharpening the tooth to the sharpness indicated by curve A of Fig. 10, curve B of Fig. 11 would be lowered to that of curve C.

It is quite obvious from curves B and C of *Figure 11* that a heavy cut per tooth is desirable to do the most sawing with whatever power is available. From the standpoint of power alone, sharpness is of little importance in heavy cuts, but it plays the major role when feed rates are light.

Exploitation of the power savings of heavy feeds is, of course, subject to limitation by gullet capacity and the possible overheating of the saw, if not water-cooled. Lack of sharpness when making heavy cuts cannot be ignored, because of resultant overheating and inaccuracies in cutting.

The four-way breakdown of energy distribution in a cut actually is not restricted at all times to the material that forms each separate chip. Some of the earlier dynamometer tests showed practically identical readings for successive equal cuts, yet other tests resulted in wide variation in readings. A peculiarity noticed was that the varying readings did not tend to center around an average value. Instead, close inspection revealed that the readings consisted of two sets of values, one high and the other low. When these readings were plotted in the sequence in which they were obtained, the resulting graph showed an alternation from high to low to high, and so on, as shown at A in *Figure 12*. These alternating series of readings usually occurred with heavy feeds, and it was suspected that tooth dullness would cause the tooth to tend to ride up over the wood and take a thin cut, followed by an extra-heavy cut because the tooth could not ride over the wood and had to take its ordained cut plus that left over from the preceding thin cut.

To test this theory, a factory-fresh tooth was used to make cuts at two feed rates, one light and one heavy, then sharpened to a mirror finish and used to make a similar series of cuts. With the light feed rates, the dynamometer readings were very uniform for the sharpened tooth, but alternated between high and low values for the factory-fresh tooth, confirming the theory thus far. But, surprisingly, when the heavy-feed values were plotted, the situation was reversed; the sharp tooth gave the alternating high and low values; the unsharpened tooth gave the uniform values.

The correct explanation for the alternation of energy consumption values was eventually traced to a distribution of the saw-tooth energy to parts of the wood outside of the immediate cutting zone represented by the chip. The face of the tooth acts as a wedge to shear the chip from the sides of the kerf, which is desirable, and at the same time it causes thick chips to shear crosswise of the cut, which is undesirable from an energy-consuming standpoint but necessary to permit the chips to enter and fill the gullet.

All the force exerted on the chip by the face of the tooth is not, however, applied wholly in the direction of the chip shear planes, (direction A, *Figure 13*). Part is exerted in the direction B (*Figure 13*), thereby putting a compressive force on the end of the chip in the vicinity of the cutting edge. The area of arrows suggests the general area that might be subjected to compression in this way. If great enough, this pressure may cause the wood to split at or a trifle ahead of the cutting edge, in the vertical direction, as at C, or along the sides of the chip above and below the cutting line, as at D in the top view. The splitting along the side causes a rough surface on the board. The splitting beyond the cutting line consumes extra energy on this cut, and the dynamometer so indicates. If the next cut occurs along the line E in Fig. 13, much of the chip breakup and side-loosening has already been done by the preceding cut, reducing the dynamometer measurement by the amount of energy previously expended on the chip. On the next cut, at F in Fig. 13, the conditions of the first cut are repeated and extra energy is expended in again producing the split condition of the second cut.

The exact repetition of high and low energy values will result when the depth of the advance splitting equals the depth of the next cut. If the following cut occurs at E of Fig. 13, the pre-split portion will be cut off without causing splitting beyond the cutting line, thus leaving the wood for the third cut in the same condition as that for the first. If the second cut is at F, the tooth will be cutting in unsplit wood and will cause pre-splitting in the same manner as the first cut. After the first cut, the energy consumed will be uniform. If the second cutting line occurs at G, the energy consumed will be low because of the advance splitting, and these splits may or may not be lengthened by the second cut. The energy for successive cuts under these conditions may vary in a systematic manner, ranging from a uniform sinusoidal wave from (*Figure 12, B* and *C*, 12.5 mil feed) through a modulated wave form (*Figure 12, C* and *E*, 75 mil feed) to a dampened wave form (*Figure 12, D*, 75 mil feed). These sequences of energy consumption per cut at various feed rates are not unusual, nor is the reduced

variation at a heavier feed, shown at B *(Figure 12)* for the 50 and 100 mil feed rates. It is possible that this variability in load on successive teeth may start the vibrations that cause washboarding, but no tests have been made to verify this conjecture.

The splitting at the bottom and sides of the cut resulting from tooth pressure on the chips raises the question of how that pressure is distributed over the tooth face. To find out, teeth were coated with blue layout lacquer. This coating wore off at the high pressure areas during test cuts, leaving a pattern of bare steel, as shown in *Figure 14* for light feeds. This pattern is typical for swaged teeth, the only variation being in the width of the bare area adjacent to the cutting edge. For heavy feeds, the pressure area might widen back to the broken line indicated by the arrow, with no appreciable widening of the side areas.

The lack of wear or pressure on the central part of the tooth face is sometimes shown by crosswise curvature of the chip, showing that it has bowed out over the center of the tooth due to tooth pressure and the shear and frictional resistance of the sides of the cut. This bowing of the chip causes higher pressures on the walls of the cut, and requires additional energy. This can be shown by cutting narrow strips of wood that are various fractions of the width of the tooth; when energy consumed is plotted over width of cut, a sloping straight line is obtained. By next varying the portion of the tooth used, but having one corner cutting, a second graph can be developed parallel to but somewhat higher than the first. This constant increase is due to side shear along the working side of the tooth. If the tooth is cutting full width, with both sides working, another increase equal to the first could be expected. Actually, an increase is obtained, but it is considerably greater than that which would be expected from the additional side shear, indicating that the chip fits tightly in the kerf, and is possibly arched, requiring considerable energy to move.

Can Saws Be Improved?

With complete knowledge of the behavior of wood during any type of cutting and of the mechanical and thermal stresses placed on cutting tools, it should be possible to devise a saw that would incorporate the most desirable features of operating conditions, saw materials, and saw design to the highest degree for a given type of sawing operation. Any attempt to design the ultimate saw on the basis of present knowledge would be premature, but certain facts already established might lead to some improvement.

Duo-Kerf Rip Saw

The action of the chip during formation and removal from the saw kerf offers an important lead to improvement. In breaking the sides of the chip free from the walls of the cut, sloping grain will cause the shear plane to run into the stock on one side of the cut, causing some fibers to buckle and break off or be torn out of the kerf surfaces. This tearing makes the surface appreciably rougher, requiring heavier dressing later to produce a smooth board. The tight fit of the chip between the rough kerf walls requires power to remove the chip from the kerf. One modification of the sawing action can get rid of most of these two objectionable chip actions. When this modification was applied to a 14-inch, 13-gage bench saw, the smooth surface and thin kerf shown by the lower half of the specimen in *Figure 15* resulted. The upper half was cut with a standard saw of the same diameter and gage.

The modification is simple. All that is necessary is to widen the initial kerf as soon as possible after it is started, in order to permit free movement of the chip after release and to provide a zone into which sloping grain can run without extending into the uncut fibers of the stock. Now, at first glance, "kerf widening" does not seem to conform with a desire to reduce scrap, but the term is used only in a relative sense. The "widened" kerf need never be wider than that of any saw that would be replaced; in general, it will be appreciably less. Obviously, to permit widening the initial kerf without increasing over-all kerf requirements, initial kerf must be thin.

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The application of the double or "Duo-Kerf" system developed at the Laboratory to a circular saw is shown in generalized form for a swage-set saw in the lower part of *Figure 16*. Narrow "chiper," teeth alternate with "side-dresser" teeth that are wider and lower. The chipper tooth can be an ordinary swaged tooth, with very little set, and may be thinner than the saw plate, as suggested by the broken-line face view. The side-dresser tooth is wider than the thickness of the saw plate by the amount of side clearance required, which is less than usual because of kerf smoothness. The side-dresser tooth preferably has parallel sides and a concave face, although a flat face may be used. When the radius (*r, Figure 16*) of this face equals the face width k_t, the angle at the cutting edges will be 60°; a smaller radius will give a sharper edge. The drop (*d, Figure 16*) of the side dresser should be slightly, but only slightly, more than the maximum feed per chipper tooth, and the length of the side-dresser edges and the thinned portion of the chipper tooth must be equal to or more than *d*. The hook angle of the side dresser may vary from any reasonable positive hook to as much as 30° negative hook without change in power consumption. Beyond this limit the fibers are not completely detached by the side dressers. As a result, these partly detached fibers restrict the movement of the chipper-tooth chips, and add to the sawdust to be carried out by the chipper teeth.

The volume of sawdust removed by each type of tooth will depend on the two kerf widths used. Equal tooth spacing and gullet profile area may be used, but for great efficiency they should be suitably adjusted, as indicated by the broken-line profile shown. Initial kerfs ranging from about 90 percent down to 60 percent of the final kerf have been used. For a ratio of 80 percent, the chipper teeth remove 80 percent of the sawdust and the side dressers remove the remaining 20 percent; therefore, the chipper-tooth gullet should have a profile area 80/20, or four times, the side-dresser gullet profile area.

The sequence of chip removal presented in *Figure 16* shows in solid black the portions of kerf that are removed by successive teeth. The first chiper tooth starts the cut with a chip k_1 wide. Next, the first side-dresser tooth cuts material from both sides of the kerf to a width of k_t, and to a depth slightly short of the bottom of the first chipper-tooth cut. Following this kerf widening, the second chipper tooth advances the narrow kerf, ejecting the sawdust into the widened kerf behind it. The second side-dresser tooth then widens most of this new chipper kerf along with the remnant left by the first side-dresser, preparing the kerf for easy removal of the chip produced by the third chipper tooth.

When the cutting direction is not parallel to the fiber direction, one of the sheared sides of the chipper-tooth chip will tend to run into the stock, but, as shown in the upper right sketch of *Figure 16*, the shear plane forming the right side of the newly cut ship, *C*, runs out in the bottom of the wider kerf instead of tearing into the kerf surface, thus avoiding unnecessary power consumption and surface marring.

Other Applications of Duo-Kerf

Application of Duo-Kerf principles is not limited to solid-tooth circular saws. Inserted-tooth circular saws may be adapted to Duo-Kerf operation in several ways. Simplest, though least effective in power saving or surface improvement, would be the use of standard full-length (new) teeth of, say, ¼-inch width in alternate sockets, and of 5/16-inch standard teeth shortened as much as possible, in the remaining sockets. The normal rough surface would be obtained, but better surfaces would be obtained by converting the short teeth to the side-dresser form. It would not be difficult, of course, to manufacture properly proportioned insert bits in the two styles needed. Since side-dresser gullets need not be so large as chipper-tooth gullets, more pairs of teeth could be put into new saws by providing alternate large and small sockets, the smaller ones being positioned nearer the saw center to give the drop (*d, Figure 16*) required for higher feed rates. This change would not, of course, be required in band saws.

As with solid-tooth circular saws, Duo-Kerf could be applied to any band saw of sufficient thickness to be swage-set. Blades too thin for swaging could be fitted by leaving the chipper teeth without set and spring-setting the side-dressers for a distance slightly greater than the drop (*d, Figure 16*). As a possible alternative, each tooth could be made into a combined chipper and side dresser by leaving the point without set for a short distance, and setting the lower part of alternate teeth to one side and of the remaining teeth to the oposite side. The set portion of the tooth would, of course, be parallel to the width of the blade.

What Duo-Kerf Offers

Duo-Kerf, when cutting the same kerf as a conventional circular headsaw, uses 20 to 25 percent less power because of the lessened resistance to chip removal. This means that a higher production rate can be gotten without increasing the saw stresses or causing less accurate sawing. The many underpowered mills in the industry could thus benefit without change in power plant. If a mill elects to retain its present production rate, the decreased power requirements would give a more lightly stressed saw, equivalent to a stiffer saw that would cut with greater accuracy.

Any gain in accuracy increases the premium offered by the smooth surface of Duo-Kerf in reducing the dressing allowance necessary for finish lumber, thus increasing yields, decreasing drying costs, giving less work to the planer, and reducing the shavings-disposal problem. A saving of even 1/32 inch in dressing allowance amounts to nearly 4 percent of 4/4 finish lumber. Even rough lumber can benefit from an improved surface through increased market acceptability. On box slats intended to carry printing, a smooth surface would eliminate the material and labor lost in dressing those slats.

These gains from Duo-Kerf can be further amplified. The smooth surface makes possible a reduction in side clearance. Reduced side clearance means less kerf, therefore less saw stress and greater saw steadiness with the same saw plate. The interlocking combination of reduced power, increased accuracy, and thinner saws can be resolved in favor of any one benefit, as individual needs dictate.

What Will Duo-Kerf Cost?

It would not be reasonable to expect large profits to start rolling in because of a switch to Duo-Kerf teeth without some stimulating investment. Money, however, is not the primary stimulant needed. The necessary stimulant—one that must be fostered by the lumber industry itself—is an acceptance of the fact that precision products result only from careful use of good tools and a determination to make the new method deliver the goods.

Bugs undoubtedly will develop in the Duo-Kerf system as practical tests are made. If special tools, materials, or methods are needed to overcome a lack, there should be no hesitation about employing them. The second wood-using industries do not balk at providing tool rooms that can handle with precision the special jobs imposed by formed cutters, high-speed precision machines, glue-line abrasion, and special gluing and forming technics, because they pay off. The primary wood-using industries cannot afford to do less, for better sawing requires better tools and better care.

It is not likely, however, that Duo-Kerf will require excessive servicing or elaborate equipment. The saw that cut the surfaces shown in *Figure 14* was not fitted by an expert, and the only pieces of equipment used were a flat file, hammer, cold chisel, and hand electric grinder, plus a few carriage bolts, a dowel, and a piece of plywood for a crude jig. Simple tools, carefully used, probably will be adequate for servicing. It will be possible to slap a set of alternating new ¼-inch bits and old (short) 5/16-inch bits into an inserted-tooth blade, hang the saw on a bent spindle against a dirty, burred-up collar, and still save perhaps 10 to 15 percent on power, but the full benefits of Duo-Kerf will come when it is fitted and used for precision sawing. The mounting of saws on taper-bored sleeves that are removable as a unit from tapered arbors may permit the tool room to do a really effective job

of saw fitting without increasing down time of the machines. Other effective procedures can be developed by the industry.

How Industry Can Help To Develop Duo-Kerf

No one segment of the wood-using and woodworking equipment industries can make Duo-Kerf fully effective. Saw manufacturers and makers of saw-fitting machines eventually will have to provide the necessary blades, swages, and grinders. In the meantime, saw users could modify their present band and solid-tooth saws along the Duo-Kerf line with some immediate gains, which will increase as gullets are gradually altered to the desired proportions. Users of inserted-tooth saws may, if their feed rates are not too high, use standard inserted-tooth bits suitably modified, if they will use care in inserting and adjusting the bits and holders. Redesigned bits could be provided readily, but gullet changes, such as alternation of No. 4 and No. 2½ styles, would call for factory alteration of existing saws or incorporation in new saws. Bench saws would, of course, be the most readily changed to Duo-Kerf.

The exact changes needed—the ratio of initial to final kerf, and the side-dresser hook angle—may have to be determined on a commercial operation basis. As stated before, the power savings are uniform over a wide range of these factors and for markedly different types of wood. Smoothness of surface, however, is somewhat dependent on the ratio of initial to final kerf for some woods, and much work remains to be done on this phase.

The Forest Products Laboratory has done the basic work needed to establish the Duo-Kerf system. Some exploratory tests on commercial-type equipment have been made, but not under conditions of sustained production. The facilities of the Laboratory are too limited, however, to fully explore the many different conditions existing in industrial use, and it is earnestly hoped that industry will apply its own resources to some of the practical problems involved.

Corrosion—X of Series

Stainless Steel Castings, Valves and Fittings Beat Corrosion in Paper Industry

N. S. MOTT[1]

Considering that paper is a commodity which is produced in quantities approximating one third by weight of all the steel produced, it is easy to see why problems of corrosion and equipment maintenance attract such a wide interested audience. To meet the enormous production demands, equipment must provide continuous service and maintenance time must be kept to an absolute minimum . . . and the big factor in assuring this, is the proper choice of alloys. To fully understand the corrosion problems which have to be faced, a brief review of the manufacturing processes involved is considered advisable.

Cellulose fibers are the basis of paper. Although for some fine papers, the fibers are obtained from linen and cotton rags, the main source of supply is from wood pulp. There are two distinct steps in the conversion of the raw wood into the finished paper. These are: (1) the manufacture of pulp from the wood and (2) the conversion of the pulp to paper. Each of these require chemical as well as mechanical processing, and a considerable number of problems involving corrosion and/or abrasion have to be contended with.

[1] Chief Chemist, Metallurgist, The Cooper Alloy Foundry Co., Hillside, N. J.

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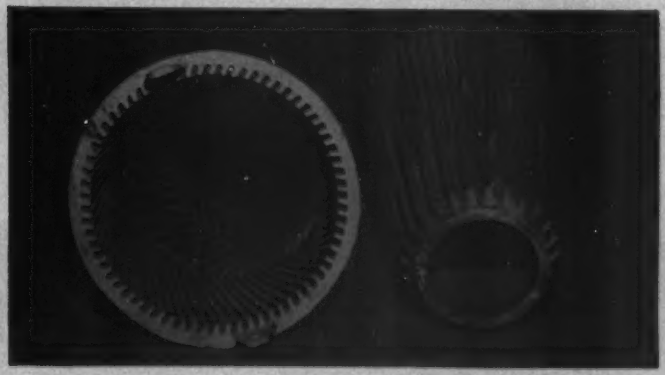

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Groundwood Mills

The manufacture of groundwood pulp usually contains some wood acids but otherwise presents no particular corrosion problems. Groundwood pulp

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is sometimes bleached and mixed in various proportions with other pulps for use in tissues, cheap books and magazines, wallpaper, etc. Bleaching involves corrosion problems discussed later under that topic. The largest use of groundwood pulp is for newsprint which is only called on for short service and then is destroyed. This consists usually of 80 percent groundwood pulp and 20 percent sulfite pulp. Groundwood pulp and newsprint can be handled without corrosion through the use of 18 percent chromium-8 percent nickel stainless steel.

In the chemical processes, the wood chips are cooked in digesters, and are then blown into a blowpit where the pulp is washed and then pumped to a stock chest.

Soda Mills

The soda process uses a cooking liquor consisting of a solution of sodium hydroxide containing some sodium carbonate. Corrosion problems are essentially those of handling caustic solutions. Fittings, valves and pump parts to handle this caustic may be made of 18-8S (ACI CF-8), except where the solution is very hot and strong. For these more severe conditions, 18-8SMo (ACI CE-8M) molybdenum bearing stainless, FA-20 (ACI CN-7MCu) or monel metal (nickel copper) serve very well.

Sulphate Mills

At present more pulp is produced by the sulfate or kraft process than by any other method. The white liquor for cooking consists of a 4.0-6.5 percent sodium hydroxide solution with 1.0-2.0 percent sodium sulfide and small amounts of sodium carbonate, sodium sulfate, sodium sulfite, and sodium thiosulfate. Corrosion problems present themselves throughout the whole cycle of cooking and recovery.

In the piping system, fittings, valves and pumps of 18-8S are recommended for handling the black, green or white liquors, although 12 percent chrome alloys stand up well in some cases. Where the temperature is very high, 18-8SMo or FA-20 is recommended.

Flue gases from the combustion of the black liquor contain sulfur dioxide, sodium sulfate, dust and large quantities of water vapor. Where these are cooled below the dew point, intense corrosion may start as a result of the sulfuric acid formed, and it is advisable to use 18-8SMo or FA-20 to resist the action of this acid.

Sulphite Mills

In the sulfite process, pulp is produced by subjecting wood chips to digestion with a bisulfite solution or "cooking acid" which contains 6-10 percent total sulfur dioxide of which 1-2 percent is combined as bisulfite of calcium. Other bases, such as magnesium, sodium or ammonium are now used in some mills. Cooking takes place in a digester that is usually constructed of steel with acid proof silica brick linings. Cover plates and top and bottom sleeves of the digester should be made of chromium-nickel alloy such as 20-10, or 29-9, or 18-8SMo. When cooking is complete, the contents of the digester are blown into the blow pit where the pulp is washed. The discharge valve and blow pipe are usually made of 29-9 or 18-8SMo and the latter is cast centrifugally in the stainless alloys. A blow target plate of cast 18-8 is found to give a very long life.

Sulfur dioxide and hot acid are recovered through relief lines in the head of the digestor and from the blow pit. A hot acid recovery system re-

TYPICAL MECHANICAL PROPERTIES OF CAST ALLOYS

Alloy Type	Tensile Strength PSI	Yield Point PSI	Elongation in 2" %	Reduction of Area %	Brinell Hardness Number	Charpy Impact	Conditions of Heat Treatment for Properties Hardened & Stress Relieved
12Cr	197,000	139,000	16	42	372	13	Water Quenched From 2000°F
18-8S	75,000	45,000	55	55	140	75	"
18-8SCb	85,000	50,000	50	50	150	40	"
18-8SMo	90,000	55,000	50	55	155	58	"
18-8SMoCb	90,000	55,000	45	50	160	50	"
20-10S	80,000	50,000	55	55	150	75	"
29-9	81,000	45,000	10	13	204	10	As Cast
25-12S	80,000	45,000	40	45	160		Water Quenched From 2000°F
25-12SMo	95,000	60,000	20	20	185		"
20-29MoCu	75,000	45,000	40	45	145	15	"
Hastelloy-C	75,000	48,000	12	13	205		Annealed
Monel	65,000	33,000	25	28	150	75	As Cast
Monel "S"	130,000	100,000	2	2	350	3	Age Hardened
Nickel	55,000	25,000	20	22	150	85	As Cast

PIONEER FOR 25 YEARS IN...

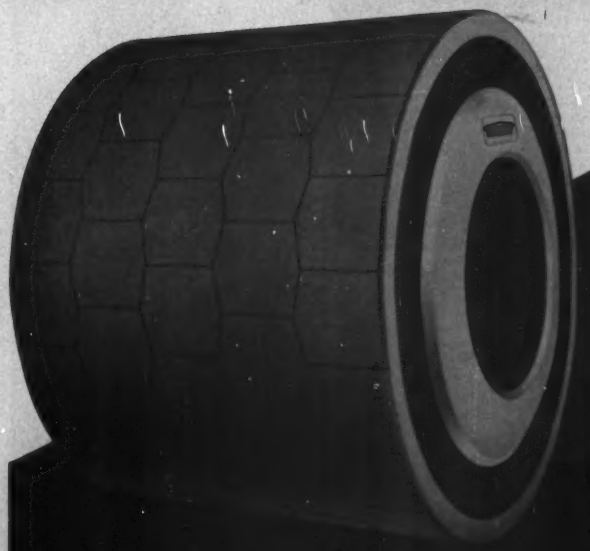
Pulpstone Engineering

1926 marked a new era in groundwood production. For the first time the grinding of pulp became a controlled operation with the introduction of the Norton Pulpstone whose abrasive, grit size, hardness and structure could be accurately selected to produce just the desired type of pulp.

And Norton has continued to pioneer — not only in improvement of the stone itself but also in providing complete pulpstone engineering service. You'll find that the Norton pulpstone engineer can not only specify just the right kind of stone to meet your pulp requirements but that his years of experience in the pulp and paper industry will enable him to give you many helpful suggestions for producing better pulp—*and more economically.*

Behind him at Worcester he also has available skilled engineers on abrasives and grinding wheels for knife grinding, roll grinding and other applications, experts on high temperature refractories and porous mediums, on grinding machines, and the many other Norton products.

NORTON COMPANY, WORCESTER 6, MASS.
Norton Company of Canada Ltd., Hamilton, Ont.



NORTON
PULPSTONES

Making better products to make other products better

Abrasives · Grinding Wheels · Grinding and Lapping Machines · Refractories · Porous Mediums · Non-slip Floors · Norbide Products · Labeling Machines

TYPICAL PHYSICAL PROPERTIES OF CAST ALLOYS

Alloy Type	Density Lbs/Cu In	Sp. Gr.	M. P. °F	Specific Heat 32-212°F BTU Lb/°F	Thermal Exp. Coeff. 32-212°F X 10⁻⁶ in/in/°F	Thermal Conductivity 32-212°F BTU/Ft²/Hr/°F/in	Electrical Resistivity Ohms/Cir mil Ft 32°F
12Cr	.277	7.67	2700—2790	.11		174	364
18-8S	.286	7.92	2550—2650	.12	9.6	113	420
18-8SCb	.292	8.09	2550—2630	.12	9.3	112	420
18-8SMo 18-8SMoCb	.292	8.00	2500—2550	.12	8.9	108	420
20-10S	.289	7.92	2550—2600	.12	9.6	113	420
29-9	.280	7.75	2600—2700	.14	7.6		
25-12S 25-12SMo	.279	7.73	2550—2650	.14	8.3	104	480
20-29MoCu	.287	8.02	2650	.12	7.8	145	580
Hastelloy C	.323	8.94	2320—2380	.09	6.3	87	800
Monel	.310	8.63	2400—2450	.13	6.9	180	320
Monel "S"	.303	8.36	2300—2350	.13	6.8	180	380
Nickel	.303	8.34	2540—2600	.13	7.4	410	125

and 25-12SMO are often used for added resistance over 18-8S and 20-10S. In extremely corrosive situations, FA-20 is specified.

The acid plant which supplies the cooking liquor maintains a sulphur burner to produce sulfur dioxide. The sulfur dioxide is cooled as quickly as possible to avoid formation of sulfuric acid. It is then pumped into the bottom of a limestone tower through which water is percolating. Here the bisulfite cooking solution is formed. This is pumped to the digesters through lines containing stainless steel fittings, valves and pumps.

In the sulfite process, the trend is to get away from the use of copper. The acid and relief lines, especially those piping hot acid, usually are of 18-8SMO. Pump parts and fittings are castings of similar composition. Digestion accessories such as steam injectors, valves, fittings, thermometer wells, test cocks, check valves etc., which are in contact with the hot acid, must be of stainless steel. All bronze or copper alloys should be eliminated from the cooking system, as at higher tempera-

claims heat and sulfur dioxide which are returned to the cooking acid for re-use.

The confinement of sulfite liquor, especially in a relatively small space in the presence of air, often results in time in partial oxidation to small amounts of sulfuric acid. This is prevalent in relief systems which are not blown out or completely drained during shut down periods. Local corrosion may also result under calcium deposits saturated with sulfite liquor by oxidation to sulfuric acid. To obviate corrosion by these small percentages of sulfuric acid, 18-8S is necessary and 18-8SMo recommended, if possible, as it resists over a much wider range of concentration and temperature. 18-8SMo can be used very successfully in all parts of the digestion system; however, because of its higher price, greater economy is realized by limiting its use to parts where its higher degree of corrosion resistance is demanded, and using 18-8S, 20-10S and 29-9 in applications where they serve satisfactorily. An alloy used quite extensively in Sweden, but not to any great extent in this country is low carbon 28-3 with molybdenum. In this country, 25-12S

ALLOY RECOMMENDATIONS FOR CORROSION RESISTANCE

Corrosive Chemical	Carbon Steel	12Cr	18-8S	18-8S Mo	FA-20	Hastelloy C
Alkaline cooking liquors		S	R			
Aluminum sulfate (alum)	X	X	N	R	R	
Aniline dyes (acid)	X	X	S	R		
Chlorine gas (dry)	S	S	S	R		
Chlorine gas (wet)	X	X	X	X	X	N
Calcium hydroxide (lime)		S	R			
Calcium hypochlorite	X	X		S	R	
Calcium sulphate (gypsum)	S	R	R			
Hydrogen peroxide	X		S	R		
Resin emulsions		S	R			
Sodium carbonate (soda ash)	S	R				
Sodium hydroxide (caustic soda)			S	R	R	
Sodium hypochlorite	X	X		S	R	
Sodium peroxide	X		S			
Sodium silicate (water glass)	S					
Sodium sulfate (salt cake)			S	R		
Sodium sulfide	X	X	S	R		
Sodium sulphite		S				
Sodium thiosulfate (antichlor)		S				
Sulphur (molten)	X	X	N			
Sulphur dioxide (dry gas)	S					
Sulphur dioxide (solution)	X	X	S	R		
Sulphur dioxide (spray)	X	X	X	S	R	
Sulphite liquor (acid cooking liquor)	X	X	S	R	R	
Sulfuric acid (dilute)	X	X	X	S	R	

Ratings:

S—Generally suitable for corrosive resistant usage.
R—Recommended for a *better* degree of corrosion resistance over alloy to the left in the table. Especially when hot, strong, or acid contaminated solution is used.
N—Necessary to use over alloys to the left in table for satisfactory corrosion resistance.
X—*Not* sufficiently resistant in the corrosive media to allow usage.

CAST ALLOY TYPES USED TO COMBAT CORROSION—EQUIVALENT DESIGNATIONS—TYPICAL CHEMICAL COMPOSITIONS

Alloy Type	ACI Desig.	AISI Desig.	ASTM Designation	Other Desig.	Chemical Composition C	Cr	Ni	Si	Mo	Others
12Cr	CA-15	410	A157-44 Grade C6		.12	12.5	.5	.75		
18-8S	CF-8	304	A296-49T Grade CF-8	KA2S	<.08	19	9	1.25		
18-8SCb	CF-8C	347	A296-49T Grade CF-8C		<.08	19	9	1.25		Cb 8xC (1.0 max)
18-8SMo	CF-8M	316	A296-49T Grade CF-8M	KA2SMo	<.08	19	9	1.25	2.5	
18-8SMoCb	CF-8MC	318 317	——		<.08	19	9	1.25	2.5	Cb 8xC (1.0 max)
20-10S	CG-12	308	A296-49T Grade CG-12		<.12	20.5	10.5	1.25		
29-9	CE-30	312	A296-49T Grade CE-30		.30	29	9	1.5		
25-12S	CH-10	309	A296-49T Grade CH-10		<.10	25	12	1		
25-12SMo	CH10M	——	——		<.10	25	12	1	2.5	
20-29MoCu	CN-7MCu	——	——	FA-20	<.07	20	29	1	3.5	Cu 4
Hastelloy C	——	——	——	Dupont #1634	<.15	17	51	1	19	W 5 Fe 6
Monel	——	——	——	——	.25		63	1.5		Fe 2.5 Cu Bal
Monel "S"	——	——	——	——	.25		63	4		Fe 2 Cu Bal
Nickel	——	——	——	——	.50		97	1.5		Fe .5

SMIDTH

ROTARY KILNS

For

REBURNING LIME SLUDGE

The illustration above shows a modern, efficient, Smidth Rotary Kiln for reburning lime sludge at the plant of the West Virginia Pulp & Paper Co., Charleston, South Carolina.

F. L. Smidth & Co. are specialists in the design and manufacture of rotary kilns and have furnished numerous installations in many countries for burning lime, lime sludge, dolomite, magnesite, cement, ores, etc.

F. L. SMIDTH & CO.

11 WEST 42nd STREET · NEW YORK, N. Y.

LONDON · PARIS · COPENHAGEN · CANADA · BOMBAY

Hardy stainless steel check valve made with Cooper Alloy castings shown in service on sulphite digesters. These valves are exposed to one hundred and thirty pounds of steam at 450°F—also to sulphite cooking liquor of approximately 8% SO_2 content.

tures these could cause electrolytic action with the steel parts.

Chlorine Bleaching

Wood pulp, regardless of how it is made, must be bleached when it is to be used for light colored papers. Chlorine and hypochlorites are normally used for bleaching chemical pulps. In a multi-stage system, chlorine gas is used in the first stage. The gas is passed into the stock where it reacts rapidly with the lignin. After washing in the acid condition, the pulp is made alkaline with caustic soda. The sodium hydroxide dissolves products of the chlorination and combines with the hydrochloric acid. The final bleaching stages use calcium or sodium hyprochlorite. Thorough washing is necessary after each stage.

Chlorine gas and liquid chlorine when dry can be handled satisfactorily with steel, but ejectors used to introduce it into the pulp must be made of Hastelloy C in order to resist the very corrosive action of this chemical when wet; and as moisture often backs up into the chlorine piping, fittings and valves of this material are also suggested. Propellers for stirring the stock in the chlorinators should be made of FA-20. Valves and fittings for handling the hypochlorite bleach liquors should be of 18-8SMo. Wash water from the bleaching operations contains small percentages of hydrochloric acid as well as hypochlorites, and 18-8SMo piping, fittings and valves are necessary in handling this waste.

Paper Mills

Piping and equipment coverings of 18-8S are used to handle rosin emulsions, dye and alum solutions. 12-14 percent chrome alloy is cast into beater bars, providing resistance to abrasion with fairly good corrosion resistance.

Abrasion resistance coupled with a fair degree of corrosion resistance is required for Jordan or refiner bars. Shells and plugs may be cast out of hardenable 12-14 percent chrome alloy which has both the properties of good abrasion and fair corrosion resistance.

In pulp and paper production, there are about 600 different chemicals used in one way or another ranging from those used to treat boiler feed water to those added to the finished product. In the case of the pulping operation, these include caustic soda, lime, salt cake, soda ash, sodium sulfide, sulfurous acid, calcium, magnesium, sodium, ammonium bisulfites and molten sulfur. For bleaching; chlorine gas, hypochlorous acid, calcium hypochlorite, sodium hypochlorite, zinc hydrosulfite, sodium peroxide, hydrogen peroxide, sulfur dioxide, sodium thiosulfate, sodium silicate, chlorine dioxide and sodium chlorite are used. The most important chemicals that must be handled in paper manufacture are: rosin size, alum, sulfuric acid, caustic soda, clay slurries, starch, protein emulsions, calcium sulfate, resin emulsions, and various types of dye solutions and pigment suspensions.

The use of stainless alloys is recommended to handle a majority of these chemicals as superior corrosion resistance and mechanical properties give long life, freedom from replacements and general satisfaction, justifying their adaptation, because in the long run, economy is realized in spite of higher initial cost.

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PIGMENT COMMITTEE ORGANIZED

WASHINGTON, D. C. — NPA's Pigment Industry Advisory Committee has been organized into specialized groups to deal respectively with problems of pigment supply in its various categories.

Groups will cover titanium pigments, organic and inorganic chemical colors, earth and mineral colors, metallic pigments, lead and zinc pigments and antimony oxides.

Titanium pigments, in particular, are currently in short supply a meeting of industry men with NPA disclosed. Part of the difficulty is in the sulphuric acid supply, incidental to sulfur producers generally having undertaken voluntarily to allocate sulfur to their customers at a level of 85 percent of current contracts.

Although not all committee lists have been completed, among paper industry men named so far are A. F. Brown, Imperial Paper & Color Works, Glen Falls, N. Y.

PRICES

The prices below reflect market quotations in New York at the mill level on standard grades. Most orders accepted, however, at price prevailing on date of shipment. Does not include spot offerings.

PAPER AND BOARD

Standard News, Delivered Ports

Rolls, contract, per ton	$105.00/110.00
Sheets	118.00/ —

F.o.b. Mills. C.l. Frt. allowed, dock, N. Y.

Kraft— pr cwt., 40# base wgt.

Standard Wrapping Rolls	$7.75/ —
No. 1 Wrapping Rolls	8.25/ 8.50
Standard Bag	7.50/ —

Tissues— per ream 24x36 (480) 10 lbs. 2500 lbs or more

Wh. No. 1 Frd.	$1.85	/$2.50
Wh. No. 1 MG	1.85	/ —
Wh. No. 1½	1.75	/ —
Wh. No. 2	1.65	/ —
Kraft Non-Tar	1.70	/ —
White Non-Tar		

Toilet— per case of 100 rolls—1 M sheets

Unbleached 4½x4½	$8.00/$8.25
Unbleached 4½x5	‡ 6.60/ —
Bleached 4½x4½	7.10/ 8.90
Bleached 4½x5	‡ 9.85/ —
Per Case of 50 rolls—2000 sheets	
Unbleached 4½x4½	$8.00/$8.25
Bleached 4½x4½	4.95/ —
Per Case of 100 rolls—1000 sheets	
Facial, 4½x5, 2-ply	‡ $8.95/10.65

Paper Towels— per case of 3750

Wh. Jr. M'tif'd 9¼x9½	$5.65
Br. Sr. M'tif'd 10x12	4.00
Br. Jr. M'tif'd 9¼x9½	3.50
Br. Jr. Sgl. fold 10x10¼	3.35
Bldd. 7½x11, 24/25 rolls	‡ $6.00/7.55

Manila, per cwt.

No. 1 Jute Tag sheets*	$16.55/18.55
Reg. Jute M.F. 40-lb., sheets*	15.00/17.00
Wrapping Manila	8.75/ 10.50
Printing Manila	10.50/12.00

* Less usual allowance for rolls.

WORLD WOOD PULP MARKETS

First Quarter Contract Prices, Per Short Air-Dry Ton

Varying freight allowances — Atlantic Ports

	U. S.	Canadian	Swedish	Finnish	Norwegian
Groundwood	$85.00/100.00	$85.00/100.00			
Sulphate, Bleached	135.00/200.00	175.00/ —	*180.00/187.00†		Competitive
Sulphate, Unbl. Northn.		147.50/155.00	*153.00/185.00*		
Sulphate, Unbl. Southn.					
Sulphite, Blchd. (Sftwd.)	135.00/165.00	145.00/ —	*175.00/ —	Competitive	Competitive
Sulfite, Blchd. (Hdwd.)	150.00/175.00				
Sulphite, Unblchd.	132.50/150.00	132.50/150.00	*153.00/165.00		
Sulphite, Unbl'd (Glassine)		143.00/146.50	*157.00/ —		
Soda, Blchd.	140.00/142.50	140.00/142.50			

* On dock. † Delivered.

Gummed Tape—per bdl., 500 bdls. or more

90-lb. 375 ft. GSI	$6.90 / —
60-lb. 600 ft. GSI	6.90 / —
35-lb. 800 ft. GSI	7.93½/ —
35-lb. 500 ft. GSO	5.98 / —

Boards, per ton—

Filled News	‡ $107.50/ —
Plain Chip	105.00/107.50
Blchd. Mla. L-d. Chip	‡ 147.50/ —
White Pat. coated .020	‡ 170.00/ —
Kraft Liners 42 lb.	115.00/117.50
Kraft Corr. .009	122.50/126.00
Binders Boards	137.50/140.00

The following prices are representative distributors' resale prices.

Rag Content Bonds and Ledgers—
White, 20 lb.

Bonds	4 Cnts.
	per cwt.
100% Rag Ex. No. 1	‡ $70.45/ 72.10
100% Rag	62.45/ —
75% Rag	48.15/ —
50% Rag	38.90/ —
25% Rag	‡ 31.65/ 33.00

Ledgers	4 Cnts.
	per cwt.
100% Rag Ex. No. 1	$72.65/ —
100% Rag	63.90/ —
75% Rag	49.40/ —
50% Rag	40.20/ —
25% Rag	33.00/ —

Sulphite Bonds and Ledgers
White, 20 lb.

Bonds	4 Cnts.
	per cwt.
Watermarked	‡ $19.00/$20.50
Plain	‡ 18.05/ 19.50

Ledgers	4 Cnts.
	per cwt.
Watermarked	‡ 20.30/$21.80
Plain	‡ 19.35/ 20.80

White Book

Conversion Coated	Case
	per cwt.
No. 1	$23.40/$24.65
No. 2	21.90/ 23.40
No. 3	‡ 20.40/ 22.40
Machine Coated	
No. 1	‡ $18.15/$18.40
No. 2	‡ 16.15/ 16.65
Uncoated	
No. 1 Antique (Watermarked)	‡ $18.65/$19.15
Offset	‡ 17.40/ 19.90
A Grade E. F.	17.40/ 18.15
A Grade S. C.	18.15/ 18.65
B Grade E. F.	17.65/ —
B Grade S. C.	‡ 16.90/ 18.40

‡ Indicates a price change.

WASTE PAPER MARKET

The following quotations were gathered from major dealers in each market. They are an indication of the price range in which volume tonnage was moving on the date specified. Prices to mills, per ton, f.o.b. cars shipping point (includes brokers' fee.) ALL PRICES NOMINAL. SPOT OFFERINGS OR SPECIAL PACKINGS NOT INCLUDED.

	New York	Philadelphia	Boston	Chicago
	Jan. 17	Jan. 16	Jan. 6	Jan.4
No. 1 Mixed Paper	$32.00/ 35.00	$32.00/ 35.00	$29.00/ —	$33.00/ —
Boxboard Cuts	30.00/ 33.00	30.00/ 33.00	26.00/ —	38.00/ —
Mill Wrappers	30.00/ 35.00	30.00/ 35.00	30.00/ 35.00	35.00/ —
No. 1 News	37.00/ 40.00	33.00/ 40.00	33.00/ 35.00	38.00/ —
Over-issue News	40.00/ 45.00	40.00/ —	33.00/ 45.00	41.00/ —
Corrugated Containers	64.00/ 69.00	55.00/ 62.00	49.00/ 65.00	52.00/ —
New Corrugated Cuts	55.00/ 62.00	55.00/ 60.00	55.00/ 65.00	62.00/ —
Double Kraft Ld. Corr. Cuts	115.00/120.00	105.00/110.00	120.00/130.00	120.00/ —
100% Kraft Corr. Cuts	125.00/140.00	125.00/135.00	130.00/150.00	135.00/ —
Used Kraft Bags	85.00/ 95.00	80.00/ 85.00	85.00/ 95.00	65.00/ —
No. 1 Brown Kraft Paper	90.00/ 95.00	90.00/ 95.00	90.00/110.00	65.00/ —
Super Resorted Br. Kraft	100.00/105.00	100.00/105.00	100.00/125.00	90.00/ —
New Br. Kraft Env. Cuts	160.00/175.00	160.00/175.00	160.00/180.00	150.00/ —
New Br. Kraft Cuts	150.00/160.00	130.00/135.00	150.00/180.00	140.00/ —
No. 1 Gdwd Shvs.	80.00/ 85.00	75.00/ 80.00	80.00/ 85.00	75.00/ —
White Newsblanks	115.00/125.00	110.00/115.00	110.00/120.00	115.00/ —
No. 1 Flyleaf Shvs.	80.00/ 85.00	90.00/ 95.00	95.00/105.00	110.00/ —
No. 1 Soft Wht. Shvs.	180.00/190.00	170.00/175.00	175.00/195.00	175.00/ —
Super Soft Wht. Shvs.	190.00/200.00	190.00/200.00	190.00/200.00	185.00/ —
Hd. Wht. Shvs.	185.00/205.00	200.00/215.00	190.00/215.00	180.00/ —
Hd. Wht. Env. Cuts	200.00/235.00	225.00/ —	200.00/235.00	190.00/ —
New Manila Env. Cuts	140.00/150.00	160.00/165.00	140.00/165.00	115.00/ —
Col. Tab Cards	110.00/120.00	115.00/120.00	95.00/135.00	100.00/ —
Manila Tab Cards	160.00/170.00	165.00/175.00	160.00/200.00	165.00/ —
No. 1 Mixed Ledger	100.00/105.00	100.00/105.00	90.00/105.00	180.00/ —
White Ledger	125.00/135.00	125.00/130.00	125.00/140.00	125.00/ —
No. 1 Book & Mag.†	55.00/ 60.00	40.00/ 45.00	40.00/ 60.00	35.00/ —
No. 1 Rep'd. Hvy. Books†	65.00/ 70.00	50.00/ 60.00	60.00/ 75.00	55.00/ —

* Delivered. † Includes Time & Life; no coarse groundwood. ‡ Not to exceed 10% groundwood.

RAG MARKET

New Domestic Cotton Cuttings
(Prices to Dealers, F.o.b. Ship. Pt.)
ALL PRICES NOMINAL

No. 1 White Shirts	$19.00/$20.00
No. 1 Unblchd. Muslins	19.00/ 20.00
Blchd. Canton Flannels	16.00/ 17.50
No. 1 Lt. Silesias	12.00/ 13.00
No. 1 Lt. Prints	9.00/ 10.00
Wht. Bk. Blue Overalls (Blchable)	13.00/ 13.50
No. 1 Blue Overalls	7.00/ 9.00
Fancy Shirts	6.00/ 6.50
No. 1 Washables	5.50/ 6.00
Suntan Khaki Cuts	10.00/ 10.50
Mixed Khaki Cuts	7.00/ 8.00
Corduroy Cuts	4.75/ 5.25
Cottonades	4.50/ 5.00
Blchd. Underwear Cuts	20.00/ 21.00
Unblchd. Underwear Cuts	19.00/ 20.00

Old Domestic Cotton Rags
(Prices to Dealers, F.o.b. Ship. Pt.)
ALL PRICES NOMINAL

	Per 100 lbs.
Mixed White	$5.00/$5.50
Cotton Pants & Overalls	4.75/ 5.00
Thirds and Blues, Repacked	3.75/ 4.00
No. 1 Roofing Rags	2.50/ 2.60
No. 2 Roofing Rags	2.40/ 2.50
No. 3 & 4 Roofing Rags	2.20/ 2.30
Roofing Bagging	2.20/ 2.30

New Foreign Cotton Cuttings
(Prices to Mills, F.o.b. Dock, N.Y.)

	Per 100 lbs.
New Dark Cuttings	$4.75/$5.00
New Mixed Cuttings	4.75/ 5.25
Light Silesias	8.00/ 8.50
Light Flannelettes	7.50/ 8.00
New White Cuttings	nominal
New Unblenched Cuttings	nominal
Fancy Shirt Cuttings	6.50/ 7.50

Light Prints	6.50/ 7.50
Bleachable Khaki, No. 1	6.00/ 6.50
Unbl. Khaki, No. 1	5.00/ 5.50

Old Foreign Rags

(Prices to Mills, F.o.b. Dock, N. Y.)

	Per 100 lbs.
No. 1 White Cottons	$10.00/11.00
No. 2 White Cottons	7.00/ 8.00
No. 3 White Cottons	6.00/ 7.00
No. 4 White Cottons	4.00/ 4.50
Extra Light Prints	5.50/ 6.00
Old Light Prints	4.50/ 5.00
Med. Light Prints	3.75/ 4.00
Dutch Blue Cottons	4.00/ 4.50
Linsey Garments	3.25/ 3.50
Dark Cottons, European	2.75/ 3.00
Dark Cottons, Egyptian	2.50/ 2.75
Old Shopperies	2.40/ 2.50
New Shopperies	2.50/ 2.75

Bagging

(Prices to Dealers, f.o.b. N. Y.)

	Per 100 lbs.
Foreign Gunny	$7.00/$7.50
Domestic Gunny, No. 1	7.25/ 7.50
Heavy Wool Tares	7.00/ 7.50
Foreign Manila Rope	5.50/ 6.50
Domestic Manila Rope	7.50/ 8.00
Jute Strings	6.25/ 6.50
No. 1 Sisal Strings	4.50/ 5.50
Mixed Strings	nominal
Paper Mill Tares	5.25/ 5.75
No. 1 Scrap Burlap	
Foreign	5.00/ 6.50
Domestic	6.50/ 7.00
Austr. Wool Pouches	7.50/ 8.50
New Burlap Cuttings	7.00/ 7.50

MATERIALS

Aluminum, sulfate:		
coml. bags, wks.	cwt.	1.65
iron-free c.l.		3.25
Alcohol, ethyl:		
tax free, dms. c.l.	gal.	.77 / 1.02
dnld. East Miss.		
Alcohol, methyl:		
Synthetic, Zone 1, dms. c.l. flt. alld.	gal.	.44
Casein, acid-prec.:		
dom. sh. pt. c.l.	lb.	.44 / .45
imp. ex dock	lb.	.41½/ .41½
Caustic soda:		
c.l. wks. solid, 76%, cwt.		3.35
flak. & grd. 100-lb. drum		3.75
liquid 50% tanks		2.55
liquid 70% tanks		2.65
China clay:		
dom. air-float. filler, c.l. wks.	ton	10.00
water-washed, lump, filler		11.00
coating		17.60 /30.50
imported, ex whse.	short ton	15.20 /28.35
Chlorine:		
single-unit tanks, works	cwt.	2.70
multi-unit	cwt.	3.20 / 4.40
Formaldehyde:		
USP, ink, dms, c.l. wks.	lb.	.0605/ .0625
l.c.l. E. wks.		.0650/ .0675
Fuel oil:		
Bunker C, No. 6 Cal. bvy tanks, refinery	bbl.	1.95 / 2.15
light	bbl.	2.05 / 2.10
Hydrogen peroxide:		
USP, 35% chys. E. of Miss.	lb.	.24½/ .25½
Lime:		
hydrated, bags, wks. Buffalo	ton	12.50
Rosin:		
B gum, drms, c.l. Savan.	cwt.	8.00
G, H, I, K	cwt.	8.70
FF, wood, do.	cwt.	7.30
Rosin size:		
70%, gum & pale grds, tank cars, south, sh. pt.	cwt.	6.80 / 7.00
Salt cake:		
dom. bulk, c.l. wks.	ton	17.00
wks. frt. all	ton	20.00 /22.00
Soda ash:		
light, 58%, bags, wks.		1.50
bulk	cwt.	1.20
Sodium silicate 40°:		
turbid, c.l. wks.	cwt.	1.20
l.c.l. wks.		1.35 / 1.95
Sodium peroxide:		
dms. c.l. E. of Miss.	lb.	.19
l.c.l. do.	lb.	.19½/ .20
Soybean, protein:		
chem. ind, wks. c.l. Cinn. and Chic.	lb.	.34 / —
Sulfuric acid:		
60° Be. chys. c.l. wks.	cwt.	1.75 / —
l.c.l. wks.	cwt.	2.05 / 2.60
Sulfur:		
crude, c.l. mines, contract,	long ton	21.00 /22.00
f.o.b vessels Gulf		22.50 /23.50
Export, f.o.b. Gulf		25.00
Sulfur dioxide:		
liquid, coml. cyl. wks.	lb.	.09
multi-unit cars	lb.	.0535
Starches:		
pearl corn, bags, c.l. wks.	cwt.	5.92 / —
white dextrines, c.l. wks.	cwt.	7.29 / —
potato, Idaho, c.l. wks.	cwt.	5.50 / —
potato, Maine, c.l. wks.	cwt.	5.25 / —
tapioca, conv. dextrines	cwt.	7.50 / 8.00
medium grds. Gulf and East Coast ports		6.75 / 7.50
low, Siam, on dock N. Y.		5.00 / 5.50 nominal
Talc:		
domestic, 50-lb. sacks, c.l. wkh.	ton	25.00 /30.00
Titanium dioxide:		
anastase, c.l. dnld., bags	lb.	.21 / .21½
l.c.l. dnld.	lb.	.22 / .22½
rutile, c.l. dnld.	lb.	.23 / .23½
l.c.l. dnld.	lb.	.24 / .24½

N.B.: For special market conditions, see *Trends*.

IMPORTS

IMPORTS AT NEW YORK

Week Ending Jan. 20

Wallpaper

Sanderson Wallpaper Co., American Miller, London, 99 bls.

C. A. Haynes & Co., American Miller, London, 88 bls.

Baryt Paper

W. Reimerdes, Havfalk, Bremen, 50 cs.

Baryta Coated Paper

Lep Transport, Inc., Vandalia, London, 108 rolls.

Remington Rand, Inc., Black Condor, Antwerp, 1 cs.

Baryta Coated Board

Lep Transport, Inc., American Miller, London, 49 rolls.

D. W. Hickey, American Miller, London, 151 rolls.

Filter Paper

H. Reeve Angel & Co., Inc., American Miller, London, 17 cs.

Stevens Nelson Paper Corp., Vandalia, London, 3 cs.

H. Reeve Angel & Co., Inc., Scythia, Liverpool, 21 cs.

Drawing Paper

H. Reeve Angel & Co., Inc., American Miller, London, 2 cs.

H. Reeve Angel & Co., Inc., Scythia, Liverpool, 2 cs.

Colored Paper

C. G. Keferstein, American Miller, London, 5 cs.

Decalcomanias

Intermaritime Forwarding Co., Havfalk, Hamburg, 1 cs.

Base Paper

Lep Transport, Inc., American Miller, London, 104 rolls (raw).

Remington Rand, Inc., Scythia, London, 83 rolls (raw).

Lep Transport, Inc., Scythia, London, 90 rolls (raw).

Surface Coated Paper

Gevaert Co. of America, Black Condor, London, 40 cs.

Filter Wads

Columbia Tobacco Co., American Miller, London, 1 cs.

Tissue Paper

Dadourian Export Corp., Havfalk, Bremen, 1234 ctns.

Wrapping Paper

Paper Corp. of U. S., American Chief, Glasgow, 20 rolls.

RECORD PAPER & PULP STOCK VALVES "BONNETLESS SELF CLEARING - - - "RESIDUE POCKETLESS TYPE"

METALS — I.B.B.M.. all iron. bronze or stainless steels. body parts plain or rubber lined.

The photo of 24" Fig. 241 I. B. B. M. valve while illustrating the gate bottom wedge system for forced gate seating and "GUILLOTINE" edge for shearing fibre at seat also shows the packing box and yoke as separate units. Both adjustable.

- The "FAST THREADED" screw stem and ball bearing speeds valve operation.
- The packing box is extra deep, is adjustable and provided with specialized lubricated packings and special type gland and compression bolts.
- The yoke mountings are such that yokes for various methods of gate operation are interchangeable.
- Replaceable gate edge shoes are used in valves 10" and larger. These shoes are of special value when valves are installed stem and pipe horizontal.

"RECORD PRODUCTS EXTENSIVELY USED IN DEFENSE PROJECTS"

RECORD FOUNDRY & MACHINE COMPANY

LIVERMORE FALLS, MAINE, U. S. A.

Coated Paper

F. P. Goskell & Co., American Chief, Glasgow, 63 cs.

Cork Import Corp., American Chief, Glasgow, 3 cs.

Rice Paper

Otto Kadron, P. Maersk, Keelung, 10 cs.

Stencil Paper

Elliott Addressing Machine Co., Trafalgar, Kobe, 45 cs.

Writing Paper

Tiffany & Co., Liberte, Havre, 4 cs.

Printing Paper

Steiner Paper Corp., Expeditor, Trieste, 3 cs.

Carbon Paper

Mahler Trading Co., Black Tern, 43 crates

Parchment Paper

G. Lippeigues, Black Condor, Antwerp, 2 cs.

Miscellaneous Paper

Irving Trust Co., Ryuka, Yokohama, 7 cs.

Rags, Baggings, etc.

A. de Vries Trading Corp., Havfalk, Antwerp, 46 bls. scrap bagging.

Irving Trust Co., Havfalk, Antwerp, 51 bls. bagging.

Darmstadt Scott & Courtney, Havfalk, Rotterdam, 133 bls. old bagging.

National City Bank, Havfalk, Rotterdam, 60 bls. bagging.

(———), Havfalk, Rotterdam, 252 bls. old rags.

Bunzle & Biach, Havfalk, Hamburg, 49 bls. scrap bagging.

Dadourian International Corp., Havfalk, Hamburg, 538 bls. rags.

E. J. Keller Co., Inc., Havfalk, Hamburg, 16 bls. rags.

Manufacturers Trust Co., Olaf Maersk, Genoa, 66 bls. old bagging.

National City Bank, American Miller, London, 79 bls. paperstock.

Mondane Co., American Miller, London, 17 bls. rags.

(———), Brooklyn Heights, Havre, 65 bls. rags.

Atlas Fibres, Argentina, Buenos Aires, 3 bls. rags.

J. Stein, Argentina, Buenos Aires, 58 bls. rags.

(———), American Chief, Manchester, 198 bls. jute waste.

A. Siegle Corp., American Chief, Manchester, 411 bls. jute waste.

Darmstadt Scott & Courtney, American Chief, Manchester, 55 bls. burlaps, 66 bls. hessian bagging, 120 bls. jute waste.

Chase National Bank, American Chief, Manchester, 48 bls. new cuttings.

Castle & Overton, Inc., American Chief, Manchester, 16 bls. new cuttings, 25 bls. gabardine rags.

H. G. Lichtenstein, American Chief, Manchester, 16 bls. new prints, 43 bls. dark prints.

E. J. Keller Co., Inc., American Chief, Glasgow, 107 bls. paperstock.

(———), American Chief, Glasgow, 186 bls. paperstock.

Castle & Overton, Inc., American Chief, Glasgow, 120 bls. paperstock.

Castle & Overton, Inc., Hoegh Silverstar, Bombay, 48 bls. paperstock.

D. Benedetto, Hoegh Silverstar, Bombay, 112 bls. old jute rags.

E. J. Lang, Hoegh Silverstar, Bombay, 100 bls. old jute rags.

Robbins Forwarding Co., Vandalia, London, 114 bls. cotton rags.

(———), Elin Horn, Alexandria, 122 bls. old colored cotton rags.

National City Bank, Elin Horn, Alexandria, 126 bls. old colored cotton rags.

Philadelphia National Bank, Elin Horn, Alexandria, 15 bls. hosiery waste.

Ottoman Bank, Cairo, Elin, Horn, Alexandria, 95 bls. hessin bagging.

Credit Smisse, Paolina, Marseilles, 77 bls. jute bagging.

Castle & Overton, Inc., Paolina, Marseilles, 72 bls. rags.

Manufacturers Trust Co., Paolina, Genoa, 206 bls. old bagging.

Cowa Trading Corp., Excalibur, Leghorn, 158 bls. cotton waste pickers.

Southern Waste Co., City of Chester, Cochin, 100 bls. old jute rags.

Midwest Waste Materials Co., Sachsenwald, Antwerp, 10 tons scrap bagging, 2 bls. nylon stockings, 263 bls. bagging, 278 bls. scrap bagging.

D. Benedetto, Sachsenwald, Antwerp, 30 bls. paperstock.

Midwest Waste Materials Co., Flying Enterprise, Rotterdam, 226 bls. scrap bagging, 39 bls. bagging.

J. Eisenberg, Flying Enterprise, Rotterdam, 101 bls. new rags.

R. Blank, Flying Enterprise, Rotterdam, 7 bls. new rags.

E. Lang, Flying Enterprise, Rotterdam, 20 tons scrap bagging.

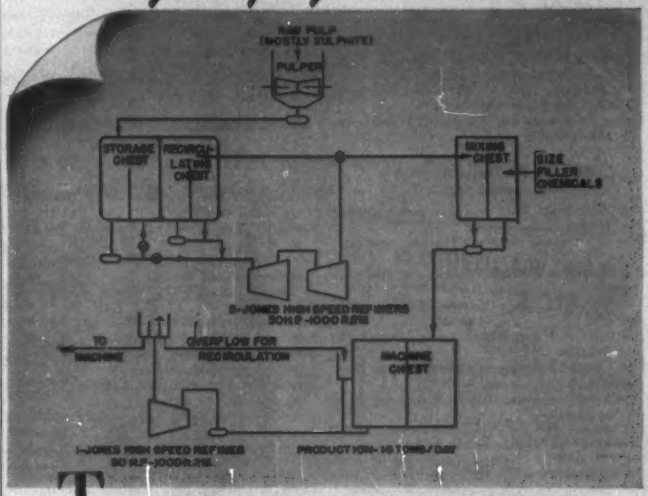
1st National Bank of Boston, Exceller, Venice, 171 bls. jute bagging.

H. Reich, Expeditor, Leghorn, 39 bls. old scrap bagging.

A. de Vries Trading Corp., Black Condor, Antwerp, 128 bls. jute waste.

E. J. Keller Co. Inc., Trouern, Dunkirk, 54 bls. old bagging.

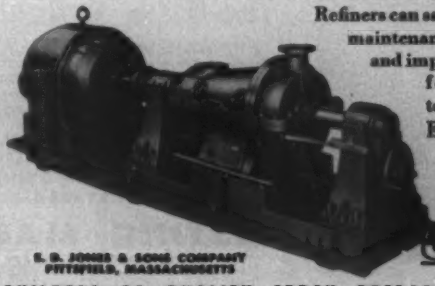
"... completely replaced 10 beaters"



The *flow-chart* above illustrates how a well-known mill in France is using 3 JONES HIGH-SPEED REFINERS in preparation of all their stock. Production at this mill is 18 tons per day of printing and bond papers . . . which figures out to 200 horsepower hours per ton for refining.

This installation is saving 20% in power — and 15 man-hours per day—and giving complete satisfaction.

To find out how Jones High-Speed Refiners can save on power, keep maintenance to a minimum and improve stock control for you, write us today for Bulletin EDJ-1011A.



E. D. JONES & SONS COMPANY
PITTSFIELD, MASSACHUSETTS

Jones

BUILDERS OF QUALITY STOCK PREPARATION MACHINERY

Old Rope

Train Smith Co., American Miller, London, 24 bls.

Casein

The Borden Co., Chemical Division, Argentina, Buenos Aires, 1000 bags.
Tupman Thurlow Co., Argentina, Buenos Aires, 600 bags.
H. S. Cramer, Argentina, Buenos Aires, 600 bags.
Eugenio Lang, Argentina, Buenos Aires, 2000 bags.
Crawford Co., Argentina, Buenos Aires, 2000 bags.
N. Y. Trust Co., Argentina, Buenos Aires, 2000 bags.
American Cyanamid Co., Argentina, Buenos Aires, 500 bags.
Tupman Thurlow Co., Bowmonte, Buenos Aires, 100 bags.
Wilbur Ellis, Bowmonte, Buenos Aires, 2000 bags.
The Borden Co., Chemical Division, Black Tern, Hamburg, 360 bags.

Bone Glue Sheets

(———), Scythia, Liverpool, 50 bags.

Woodpulp

Price & Pierce, Ltd., Scythia, Liverpool, 1855 bls. cellulose pulp.
China American Paper & Pulp Corp., Expeditor, Trieste, 1330 bls. chemical pulp.
Atlantic Forwarding Co., Expeditor, Trieste, 480 bls. chemical pulp.

IMPORTS AT PHILADELPHIA

Week Ending Jan. 20

Castle & Overton, Inc., Havfalk, Antwerp, 185 bls. paperstock.
(———), Havfalk, Antwerp, 108 bls. new cuttings.
A. L. Feierman, Havfalk, Antwerp, 62 bls. old corduroy.
E. J. Keller Co., Inc., Havfalk, Antwerp, 186 bls. rags.
E. J. Lang, American Miller, London, 77 bls. old jute bagging.
P. A. Dunkel, Bowmonte, Buenos Aires, 700 bags casein.
D. Galloway, American Chief, Manchester, 122 bls. paperstock.
E. J. Keller Co. Inc., American Chief, Manchester, 64 bls. paperstock, 83 bls. old bagging.
(———), American Chief, Manchester, 90 bls. paperstock.
Leigh Textile Co., American Chief, Manchester, 131 bls. bagging.
N. Schwab, Trafalgar, Hong Kong, 25 bls. cotton waste.
E. J. Keller Co. Inc., Flying Enterprise, Rotterdam, 99 bls. fustians, 68 bls. rags, 58 bls. prints.
Manufacturers Trust Co., Flying Enterprise, Rotterdam, 127 bls. cottons, 47 bls. old rags.
Elof Hansson, Inc., Expeditor, Trieste, 1650 bls. chemical pulp.
Glant & Co., City of Philadelphia, Madras, 73 bls. old jute rags.
1st National Bank of Boston, Exceller, Venice, 109 bls. old jute bagging.
Gottesman & Co., Inc., Iggesund, Sweden, 1,025 bls. blchd. kraft pulp, 1,000 bls. blchd. sulfite pulp; Svann, Sweden, 513 bls. prime unblchd. sulfite pulp; 3,775 bls. second quality unblchd. sulfite pulp.

IMPORTS AT BOSTON

Week Ending Jan. 20

Manufacturers Trust Co., Olaf Maersk, Genoa, 121 bls. paperstock, 72 bls. old bagging.
(———), Olaf Maersk, Genoa, 28 bls. waste bagging.
P. A. Dunkel, Bowmonte, Buenos Aires, 500 bags casein.
E. Lang, Bowmonte, Buenos Aires, 1000 bags casein.
F. H. Paul & Stein Bros., Bowmonte, Buenos Aires, 300 bags casein.
Tupman Thurlow Co., Bowmonte, Buenos Aires, 2040 bags casein.
1st National Bank of Boston, Black Tern, Rotterdam, 52 bls. rags.
(———), Black Tern, Rotterdam, 562 bls. sulphite pulp.
E. Butterworth & Co. Inc., Black Tern, Antwerp, 79 bls. old bagging.
Gottesman & Co., Inc. 1,875 bls. semi-blchd. kraft from Iggesund, Sweden.

IMPORTS AT BALTIMORE

Week Ending Jan. 20

S. Shapiro & Sons, Havfalk, Rotterdam, 70 bls. rags.
S. Shapiro & Sons, American Miller, London, 74 bls. cotton rags.
Chemical Bank Trust Co., Examiner, Oran, 494 bls. rags.
State Street Trust Co., Flying Enterprise, Rotterdam, 126 bls. rags.
S. Shapiro & Sons, Flying Enterprise, Rotterdam, 32 bls. rags.
China American Paper & Pulp Co., Expeditor, Trieste, 1000 bls. chemical pulp.
Bunge Pulp & Paper Co., Expeditor, Trieste, 380 bls. chemical pulp.
1st National Bank of Boston, Exceller, Venice, 85 bls. old cotton rags.
(———), Black Tern, Rotterdam, 86 bls. cotton rags.

IMPORTS AT NORFOLK

Week Ending Jan. 20

Castle & Overton, Inc., Havfalk, Antwerp, 105 bls. bagging.
A. de Vries Trading Corp., Havfalk, Antwerp, 70 bls. scrap bagging.
A. de Swaan, Havfalk, Amsterdam, 99 bls. scrap bagging.
Dixie Jute Bagging Corp., American Chief, Manchester, 43 bls. scrap bagging.
J. T. Flannery, American Chief, Manchester, 49 bls. old bagging.
Castle & Overton, Inc., Hoegh Silverstar, Bombay, 70 bls. jute rags.
Textile & Paper Supply Co., Hoegh Silverstar, Bombay, 100 bls. old jute rags.
National City Bank, Hoegh Silverstar, Bombay, 100 bls. jute rags.
E. J. Keller Co. Inc., Expeditor, Genoa, 93 bls. old bagging.
(———), Expeditor, Trieste, 131 bls. rags.
J. J. Rozendaal, Black Condor, Antwerp, 42 bls. bagging waste.
E. J. Keller Co. Inc., Black Condor, Antwerp, 122 bls. jute waste.

NEW LITERATURE

Towmotor Corp. Booklet, "An Engineering Achievement." Features Model "W" Electric Pallet Truck. Folder, "The Towmotor Safety Kit." Includes four brightly-hued posters each emphasizing some element of fork lift truck operation, also Operators' Guide in convenient pocket-size.

Naylor Pipe Co. Bulletin No. 507, "Naylor Light-Weight Pipe." Shows applications of new Spiralweld Pipe in construction, paper mills, sewage disposal fields, etc.

Superintendent of Documents. U. S. Dept. of Agriculture Monograph No. 6, Illustrated Book, 224 pp. price 50c, "Management of Ponderosa Pine in the Southwest." Summarizes 40 years of experimental work in Ponderosa pine management by the Forest Service Southwestern Forest & Range Experiment Station at Tucson, Ariz.

U. S. Dept. of Commerce. Trade list, price $1.00, "Pulp and Paper Mills — Denmark."

Babcock & Wilcox Tube Co. Data Card 115C. Table on tolerances for round carbon and alloy steel mechanical tubing.

Bemis Bro. Bag Co. Booklet, "Multiwall Packaging Guide." Describes and illustrates ways to use all types of multiwall paper bags more efficiently and economically. Deals with storage of empties, filling, closing, and handling of filled bags, palletizing, and related topics.

General Electric. Bulletin GEA-5534, "All New Pyrometer Equipment." Illustrates Types HP-1, HP-2, HP-3 and HP-4.

The Engineer Co. Booklet, "Enco Combustion Equipment." Highlights burner units, mechanical atomizer, pump sets, etc.

The Hinde & Dauch CRUSH TESTER

TO CONTROL QUALITY OF PRODUCT—A practical, heavy duty instrument for ring stiffness tests of liner-board and box-boards and flat crush tests of combined corrugated board. Measurements uniformly accurate. Recording mechanism independent of machine elements, eliminating friction; plunger and plate free of lateral movement.

SCHOPPER TYPE TENSILE TESTER • BASIS WEIGHT SCALES
MICROMETERS • OTHER TESTING INSTRUMENTS
STRIP CUTTERS FOR UNCOMBINED BOARD TESTS

TESTING MACHINES INC.

123 WEST 64TH STREET, NEW YORK 23, N. Y.

Important points to know about COTTRELL *Electrical Precipitators*

A COTTRELL Electrical Precipitator is a major plant investment. Once installed it is operated over a period of many years, *thus multiplying year after year the benefits of top notch design and installation.*

And because of the many factors affecting the operating and collecting efficiency of a COTTRELL Precipitator, probably in no other field do the experience and "know-how" of the organization designing and installing the unit play a more important role in influencing the overall performance of the installation. That is why it is so important to remember this fact . . .

Western Precipitation Corporation is the organization that installed the first successful COTTRELL *Precipitator over 39 years ago, still operating efficiently . . . and has consistently developed new refinements, new techniques, new applications that today have made it world famous in the science of recovering dusts, fly ash, mists, fogs and other suspensions from gases.*

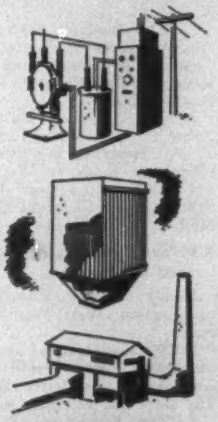
This is the first of a series of advertisements briefly outlining the important elements that go to make up a COTTRELL installation. Only long experience coupled with highest engineering ability, can assure the proper combination of these elements into a COTTRELL installation best suited to *your particular requirements!*

Basically, a Cottrell Precipitator consists of three major divisions each in turn consisting of many separate elements . . .

1. THE ENERGIZING SYSTEM, as its name implies, is the portion of the unit wherein the power is brought in, the voltage stepped up, then rectified to provide the unidirectional high voltage current supply for the Electrode System.

2. THE ELECTRODE SYSTEM consists of the high-tension ionizing electrodes and collecting electrodes through which the suspension-laden gas is passed to be cleaned. These electrodes can be of various designs, shapes and patterns and are equipped with various "rapper" arrangements which assist in keeping the electrodes clean of recovered materials.

3. THE HOUSING OR SHELL includes the structure containing the Electrode and Energizing Systems as well as the gas ducts and distributing system, the hoppers for receiving the collected material and other miscellaneous equipment.



Each of these three major divisions, together with their many individual parts, must be carefully engineered into ONE integrated and precisely-balanced unit to provide the successful and continuously-operating COTTRELL Precipitator. This series will take these major units apart to show in greater detail how the individual parts function and the varying types of design and construction. Watch for them.

10 COTTRELL ADVANTAGES

that make Cottrells unsurpassed for all types of recovery problems, hot or cold, wet or dry

1. **LOWEST DRAFT LOSS** —only a few tenths of an inch w. g.
2. **LOWEST POWER COST** —only ½ to 1 kwh. per 100,000 cu. ft. of gas cleaned.
3. **LOWEST MAINTENANCE COST**—all metal, few moving parts, no fire hazard.
4. **LOWEST LABOR COST** —operation can be fully automatic, if desired.
5. **LONGEST LIFE**—early Cottrell installation still operating after 39 years of continuous service.
6. **HIGHEST EFFICIENCY** —recovery efficiently approaches 100%, is desired.
7. **UNIVERSAL APPLICABILITY** —recover any suspension, solid or liquid—in any gas—over wide temperature ranges.
8. **ANY CAPACITY** — handle a few c.f.m.—or millions—with equal ease.
9. **MAXIMUM FLEXIBILITY** —readily adaptable to varying installation requirements.
10. **LOWEST OVERALL COST** —cost less per year of service, less per ton recovered. Often pay for themselves in a few months—always within a few years.

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1048 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 LaSALLE ST. BLDG., 1 N. La SALLE ST., CHICAGO 2 • HOBART BUILDING, SAN FRANCISCO 4, CALIFORNIA
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

Do You Have This Helpful COTTRELL Booklet? In 28 pages of interesting charts, illustrations and descriptive data, it answers many of the questions engineers ask about COTTRELL design and construction. **Send for your free copy. Ask for Bulletin C101!**

Newsprint Association of Canada. Booklet, "Newsprint Data: 1950." Statistics of world production and demand.

Handbook Publishers, Inc. Book, 73 pp., price $1.50, "The Analytical Balance, Its Care and Use," by William Marshall MacNevin. Designed to acquaint the average scientific worker with problems of selecting, mounting, testing, etc.

Squires, C. E., Co. Catalog, 33 pp., "Squires Steam Specialties." Describes and give data for sizing of steam and air taps, pressure reducing valves, pump governors, pressure regulators, boiler feed controls and temperature.

Buffalo Electro-Chemical Co., Inc. Data Sheet, "Modification of Starches, Proteins and Gums with Peroxygen Compounds." Illustrates the principle of depolymerization of these high molecular substances by means of hydrogen peroxide, and contains practical examples with various suggestions and a selection of literature references.

Atlas Mineral Products Co. Bulletin No. 4-1. "Corrosion Proof Linings."

U. S. Dept. of Commerce. PB 102 172, *Protective Coatings on Metals,* 60 pp., price $1.50; PB 102 173. Covers new literature and patent surveys since 1940.

Baker Industrial Truck Div., Baker-Raulang Co. Illustrated Bulletin, Series B, "The New Baker Type FT Fork Truck — 3000 and 4000 pounds Capacity."

Bristol Co. Bulletin, No. P1238, 56 pp. Contains a well-illustrated catalog of pyrometer supply items. Includes engineering data on modern practices in pyrometry, also tables of calibration data for the commonly-used base metal and rare metal thermocouples.

General Dyestuff Corp. Circulars G-663, Katapol K Conc. in the Paper Industry; GDC-316, Puratized PMA for Slime Control in Paper Mills. Booklet, GDC-318, Blancol Conc. Powder.

U. S. Dept. of Commerce. Bulletin, "A Program for Voluntary Protection of Technical Information." Publicizes the Department's service (OTS) to help the public guard voluntarily against the harmful release of technical information, and invites industrialists, businessmen, scientists, etc., to use this service whenever questions about release of technical information in their possession arise.

TAPPI PROGRAM

(Continued from page 14)

and Problems," by E. M. Jenkins, Johns-Manville Corp., Manville, N. J.

7. "Report on Progress of Finished Products Testing Subcommittee and Future Program," by Emile Frederick, Jr., Celotex Corp., Marrero, La.

8. "Report on Progress of Raw Materials Testing Subcommittee and Future Program," by E. M. Jenkins, Johns-Manville Corp., Manville, N. J.

9. Discussion of Freeness Testing and Test Board Formation, by a member of the Raw Materials Testing Subcommittee.

10. Business meeting and discussion of committee program for the current year.

9:15 a.m. Plastics (West Ball Room)

E. C. Jahn, New York State College of Forestry, Syracuse, N. Y., chairman.

1. "Configuration and Structure of Cellulose Xanthate," by C. Y. Chen, Ralph E. Montonna, and C. S. Grove, Jr., Syracuse University, Syracuse, N. Y.

2. "The Bonding Strength of Certain Adhesives on Liner Board," by Geoffrey Broughton and Ernest R. Kaswell, Fabric Research Laboratories, Boston, Mass.

3. "The Use of Redwood Plastic Pulps in Paper-Base Laminates," by T. A. Howells, Institute of Paper Chemistry, Appleton, Wis.

4. "Latex Coating," by Elmer K. Stilbert, Dow Chemical Co., Midland, Mich.

9:15 a.m. Alkaline Pulping (East Ball Room)

Henry Vranian, Chesapeake Corp. of Virginia, West Point, Va., chairman.

1. "Recausticizing in the Southeast" (including some practical operating suggestions), by Irwin W. Johnston, The Dorr Co., Atlanta, Ga.

2. "The Properties of High Yield Kraft Pulps Produced at Bathurst," by J. McK. Limerick, Bathurst Power and Paper Co., Ltd., Bathurst, N. B.

3. "Rate of Beating of Pre-Refined Kraft Pulps," by H. Wyatt Johnston, Sutherland Refiner Corp., Montreal, P. Q., and W. C. Lodge, Pulp and Paper Research Institute of Canada, Montreal, P. Q.

4. "Further Studies on the Alkaline Pulping of Scrub-Oak," by William J. Nolan, University of Florida, Gainesville, Fla.

5. "Redwood as a Potential Source of Pulp," by Harry F. Lewis, Institute of Paper Chemistry, Appleton, Wis.

6. "Some Factors Influencing Color Reversion of Bleached Secondary Fiber," by H. P. Bailey, J. J. Forsyth and E. F. Adams, International Paper Co., Niagara Falls, N. Y.

7. "Odor Elimination in a Sulphate Pulp Mill," by P. Ghisoni, G. Bozza, and P. Colombo, Vita Mayer & Co., Milano, Italy (by title).

9:15 a.m. Paper Making (Fourdrinier) (Room A)

Noel R. Phillips, Champion Paper and Fibre Co., Canton, N. C., chairman.

Round-table discussion of "Paper Defects — Cause and Cure." (Attendance by invitation.)

2:00 p.m. Corrugated Containers (West Ball Room)

F. D. Long, Container Corp. of America, Chicago, Ill., chairman, Panel Session on "Manufacture, Inspection and Testing of Weatherproof Corrugated Board."

1. "New Developments in Starch Adhesives," by J. E. Killinger, Penick & Ford, Ltd., Inc., Cedar Rapids, Iowa, moderator of panel.

2. "Starch Urea Adhesives," by E. S. Gantt, Corn Products Refining Co., Argo, Ill.

3. "PVA Adhesives," by E. G. Boyce, Grasselli Div., E. I. du Pont de Nemours & Co., Inc., Cleveland, Ohio.

4. "Silicate Adhesives," by Robert Kreyling, Philadelphia Quartz Co., Philadelphia, Pa.

5. "Commercial Testing," by C. J. Zusi, Container Laboratories, Inc., Chicago, Ill.

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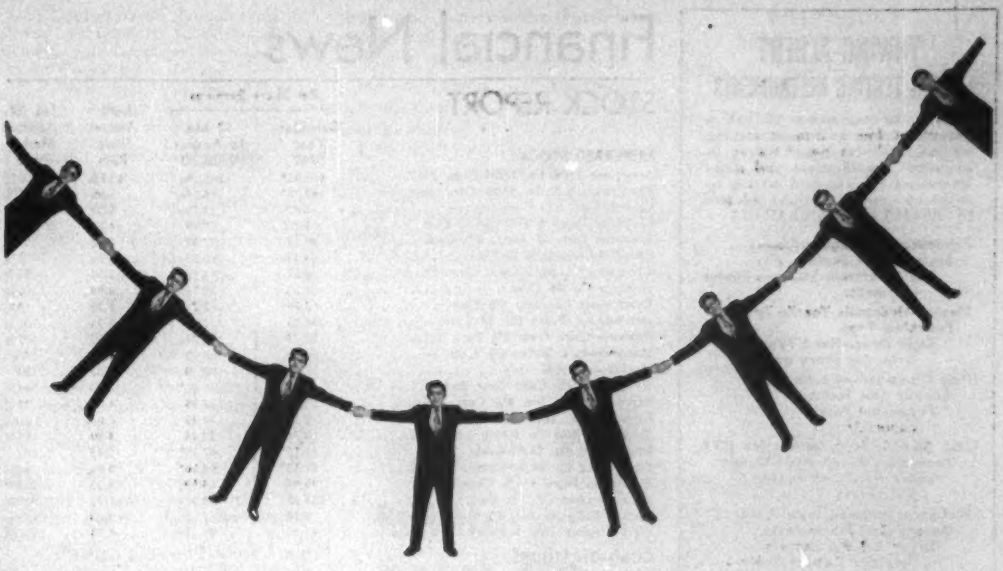

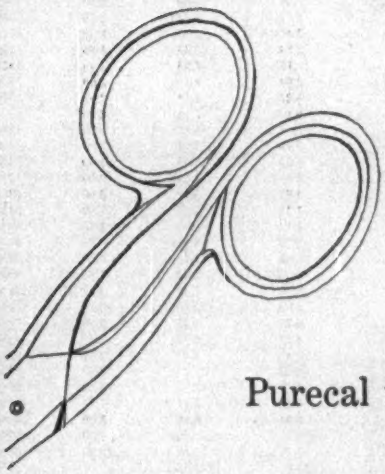

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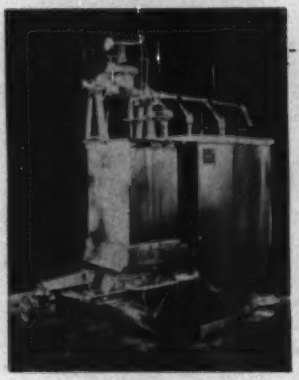

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Financial News

STOCK REPORT

	Per Share Earnings: Calendar Year 1949	Per Share Earnings: 12 Mo. to Approx. 9/30/50	Indic Annual Divid. Rate	Jan. 24 Approx. Market Price
PREFERRED STOCKS				
Armstrong Cork Co. $3.75 Cum.	$40.95*	$48.14a	$3.75	$102⅜
Armstrong Cork Co. $4.00 Cum Conv.	40.95*	48.14a	4.00	117½
Celotex Corp. 5% Cum.	6.80c	11.70e	1.00	16⅝
Champion Paper & Fibre $4.50 Cum.	60.09f	97.99	4.50	104⅜
Container Corp. of Amer. 4% Cum.	89.52	122.92	4.00	105
Crown Zellerbach $4.20 Cum.	54.38c	66.87	4.20	105½
Dixie Cup Co. $2.50 Cum. Conv. Cl. A	10.93	13.70	2.50	51⅞
Flintkote Co. $4 Cum.	62.70	79.70	4.00	106½
Robert Gair Co., Inc. 6% Cum.	13.79†	17.21†	1.20	19⅞
International Paper Co. $4 Cum.	224.55	323.40	4.00	108⅜
Kimberly Clark Corp. 4% Cum.	85.27	124.87e	4.50	107⅜
MacAndrews & Forbes 6% Cum.	61.59	63.03	6.00	140½
Mead Corp. 4¼% Cum.	51.37	88.30	4.25	94
Mead Corp. 2% Cum. Conv. 2nd	21.35*	36.30*	2.00	64¼
Pabco Products, Inc. 4% Cum. Conv.	56.46	124.88	4.00	98¼
Rayonier Inc. $2 Cum.	9.54	17.45	2.00	36¼
St. Regis Paper Co. 4.40% 1st A	30.74	52.38	4.40	95⅜
Scott Paper Co. $3.40 Cum.	51.15*	62.16*	3.40	101
Scott Paper Co. $4.00 Cum.	51.15*	62.16*	4.00	106½
Sutherland Paper 4¼% Conv.	46.92	68.59	4.25	122
U. S. Gypsum Co. 7% Cum.	283.37	429.37	7.00	185½
United Wallpaper Inc. 4% Cum. Conv.	2.14	(d)17.15	2.00	26¼
West Virginia Pulp & Paper 4½% Cum.	61.28c	92.91e	4.50	110¼
COMMON STOCKS				
APW Products Co.	(d)0.81	0.45	—	8¼
American Writing Paper Corp.	.04	0.86	0.50	8½
Armstrong Cork Co.	6.57	7.84a	3.75	50⅝
Celotex Corp.	1.65c	3.03e	1.00	17½
Certain-Teed Prods. Corp.	2.84	3.43	1.50	15½
Champion Paper & Fibre	5.15f	8.93	2.45	48¾
Congoleum Nairn Co.	2.04	2.70a	2.00	23⅜
Container Corp. of America	4.23	5.14	2.50	33⅜
Crown-Zellerbach	6.02c	7.36	2.20	51
Dixie Cup Co.	7.44	9.87	1.50	45⅝
Eastern Corp.	0.64	3.04	1.00	20½
Flintkote Co.	4.33	5.48	3.00	28⅛
Robert Gair Co., Inc.	2.11†	2.69†	0.70	12¾
Great Northern Paper Co.	4.87	3.73	3.00	48¼
International Paper Co.	7.12	8.65	2.50	53¼
Johns-Manville Corp.	4.83	6.38	3.50	48⅜
Kimberly Clark Corp.	5.29	6.81e	1.80	44½
MacAndrews & Forbes Co.	3.64	3.74	3.00	39⅞
Marathon Corp.	3.29c	4.84e	1.40	40¾
Mead Corp.	4.10	7.32	2.20	26⅜
National Container Corp.	0.95	2.00	0.75	12⅜
Pabco Products, Inc.	0.85	1.95	0.60	18½
Rayonier, Inc.	4.75	9.73	2.50	49⅝
Ruberoid Co.	7.93	8.65	3.18	53⅜
St. Regis Paper Co.	0.91	1.63	0.60	13⅜
Scott Paper Co.	6.07	7.12	3.60	43¾
Sutherland Paper Co.	4.62	6.47	2.75	48⅞
Union Bag & Paper Corp.	5.81	6.68	3.00	42½
United Board & Carton	(d)1.61b	1.56g	0.50	17⅛
U. S. Gypsum Co.	13.51	17.87	10.00	108½
United Wallpaper	(d)0.01	(d)0.37	—	4⅛
West Virginia Pulp & Paper	8.58c	12.91e	5.00	78¼

(a) 12 months to approximately 6/30/50
(b) Year ended 11/13/49
(c) Year ended 1/31/50
(d) Deficit
(e) 12 months to 10/31/50
(f) 9 months to 12/31/49
(g) 12 months to 11/11/50
(*) Earnings per combined preferred shares
(†) Excludes domestic and Canadian subsidiaries and 60% equity in Southern Paperboard Corp.

Marathon Corp. has declared an increased regular dividend on common stock and a regular dividend on preferred stock. The dividend on common stock is 50 cents a share, up 5 cents from the previous 45 cent dividend, and is payable February 28, 1951, to stockholders of record at the close of business February 9, 1951. The regular $1.25 a share on Marathon's preferred stock was declared payable April 2 to stockholders of record March 20, 1951.

The amounts of both dividends are net after provision for Wisconsin privilege dividend tax.

SUPPLY, DEMAND AND TRENDS

Morris Dobrow is to speak at the Salesmen's Luncheon, Hotel Beverly, 125 East 50th St., New York City, January 23. His subject will be "Supply, Demand & Probable Trends in Paper Industry, 1951."

6. "Quartermaster Inspection and Tests," by Capt. R. E. Willits, Philadelphia Quartermaster Depot, U. S. Army, Philadelphia, Pa.

7. "Production of Corrugated Board," by J. J. Koenig, Gaylord Container Corp., St. Louis, Mo.

2:00 p.m. Vocational Education (Grand Ball Room)

B. E. Lauer, University of Colorado, Boulder, Colo., chairman.

A. Recruiting of College Graduates.

1. "Problems of the Recruiting Agent," by Dwight Durham, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2. "Problems of the University Placement Director," by Gordon Sikes, Princeton University, Princeton, N. J.

B. Assimilation of the Technical Graduate Into the Industry.

1. "Through an Interview and Formal Training Program" (industries' view), by Robert Ralston, General Electric Co., Schenectady, N. Y.; (new employee's view), by Thomas Bink, General Electric Co., Schenectady, N. Y.

2. "Through a Short Formal Training Program," by O. A. Greiner, American Cyanamid Co., New York, N. Y.

3. "Through Immediate Job Responsibility" (industries' view), by E. L. Gibson, Carbide & Carbon Chemicals Corp., New York, N. Y.; (new employee's view), by Seymour Rose, National Adhesives Co., New York, N. Y.

2:00 p.m. Fundamental Research (Room B-C)

Harry F. Lewis, Institute of Paper Chemistry, Appleton, Wis., chairman.

1. "Mechanical Behavior of Paper, Part I," by Geoffrey Broughton, and N. A. Matlin, Lowell Textile Institute, Lowell, Mass.

2. "Sorption of Water-Soluble Cellulose Ethers by Cellulose," by Ellsworth Shriver, Institute of Paper Chemistry, Appleton, Wis. (Mr. Shriver is now with the Mead Corp., Chillicothe, Ohio.)

3. "The Mechanism of Fiber Bonding," by W. S. Wilson, Monsanto Chemical Co., Everett, Mass.

4. "The Effect of Urea and Related Compounds on the Mechanical Properties of Paper," by Henry D. Fisher, Institute of Paper Chemistry, Appleton, Wis. (Mr. Fisher is now with the Scott Paper Co., Chester, Pa.)

5. "Toward a Referee Viscosity Method," by A. F. Martin, Hercules Powder Co., Wilmington, Del.

6. "Moisture Determination in Paper in Oven Drying," by Geoffrey Broughton, Lowell Textile Institute, Lowell, Mass.

7. "Paperboard Drying" (investigation by means of an experimental drying machine), by Stanley F. Smith and B. W. Atwood, St. Anne's Board Mill Co., Bristol, England (by title).

8. "Determination of Iron in Wood and Wood Pulp," by R. M. Kingsbury, Forest Products Laboratory, Madison, Wis. (by title).

2:00 p.m. Paper Making (Fourdrinier) (East Ball Room)

Noel R. Phillips, Champion Paper & Fiber Co., Canton, N. C., chairman.

Symposium on "Fourdrinier Wet-End Variables."

1. "Slices," by Paul Boronow, Valley Iron Works, Appleton, Wis.

2. "Paper," by B. L. Kassing, Nekoosa-Edwards Paper Co., Port Edwards, Wis.

3. "Head Boxes and Slices," by D. R. Edwards, Beloit Iron Works, Beloit, Wis.

WEDNESDAY, FEBRUARY 21, 1951

9:15 a.m. Statistics (Room B-C)

T. A. Pascoe, Nekoosa-Edwards Paper Co., Port Edwards, Wis., chairman.

1. "Statistical Techniques in Maintenance of Testing Instruments," by W. Edmund Patte, E. B. Eddy Co., Hull, P. Q.

2. "Case Studies in the Application of Industrial Statistics to Papermaking," by Charles A. Bicking and Richard T. Trelfa, Hercules Powder Co., Wilmington, Del.

3. "Sampling Plans," by Geoffrey

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Broughton and M. Kennedy, Lowell Textile Institute, Lowell, Mass.

4. "Nonographic Assistance in Statistical Calculations," by W. E. Patte, E. B. Eddy Co., Hull, P. Q.

5. "The Calculation of Mullen," by Edward R. Hoffman, Hammermill Paper Co., Erie, Pa.

9:15 a.m. Chemical Engineering (West Ball Room)

J. R. Lientz, Union Bag & Paper Corp., Savannah, Ga., chairman.

1. "An Industrial Lecture Program for Students of Chemical Engineering," by Lyle C. Jenness, University of Maine, Orono, Me.

2. Symposium on Digester Construction and Operation.

a. "Factors Influencing Service Life of Brick Linings in Sulphite Digesters," by Beaumont Thomas, Stebbins Engineering & Mfg. Co., Watertown, N. Y.

b. "Corrosion Studies in Sulphate Digesters," by M. A. Scheil, A. O. Smith Corp., Milwaukee, Wis.

c. "The Effect of Silica on Digester Corrosion," by J. C. Hair and A. W. Duskin, Crossett Paper Mills, Crossett, Ark.

d. "Progress Report on the Activities of the Digester Corrosion Subcommittee," by H. O. Teeple, International Nickel Co., New York, N. Y.

9:15 a.m.—West Strength (Room A)

K. W. Britt, Scott Paper Co., Chester, Pa., chairman.

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1. "The Role of the Hemicelluloses in the Mechanism of Wet Strength," by M. N. Fineman, Rohm & Haas Co., Philadelphia, Pa.

2. "The Mechanism of the Improvement of Wet Strength of Paper by Polyethylenimine," by Paul A. Trout, Institute of Paper Chemistry, Appleton, Wis. (Mr. Trout is now with the American Box Board Co., Filer City, Mich.)

3. "Factors Affecting Retention and Efficiency of Wet-Strength Resins," by C. S. Maxwell, American Cyanamid Co., Stamford, Conn.

4. "The Rate of Wet Strength Development in Neoprene-containing Papers," by G. C. Wheeler, A. M. Borders, G. R. Sears, and J. W. Swanson, Institute of Paper Chemistry, Appleton, Wis.

5. "Super Wet Strength by the Beater Addition Process," by Francis H. Snyder, L. Spiwak, and A. E. Moyer, Snyder Chemical Co., Bethel, Conn.

6. Panel discussion on "Practical Aspects of Wet-Strength Paper Manufacture."

9:15 a.m. Preparation of Papermaking Materials (East Ball Room)

F. S. Klein, Byron Weston Co., Dalton, Mass., chairman.

1. "The Influence of Temperature During the Beating Process," by O. K. Ronning, E. D. Jones & Sons, Inc., Pittsfield, Mass., and C. E. Libby, New York State College of Forestry, Syracuse, N. Y.

2. "Description and Action of the Morden Slush-Maker Pulper," by R. Burke, Morden, Morden Machines Co., Portland, Ore.

3. "Pulping of Waste Papers and Pulp in the Dynopulper," by G. A. Peterson, Rice Barton Corp., Worcester, Mass.

4. "The Bird-Gibbs Clarifiner," by Sven Fahlgren, Bird Machine Co., So. Walpole, Mass.

5. "The Sandy Hill Peppy Peeler," by Douglas Philbrook, Northeast Pulpwood Research Center, Gorham, N. H.

6. "Apparatus for Beating Paper Pulp by Crushing Fibers Without Friction," by P. Centerick, Papeteries de Belgique, Duffel, Belgium (by title).

2:00 p.m. Microbiological (Room B-C)

R. F. De Long, Marathon Corp., Rothschild, Wis., chairman.

1. "Relation of Red Slime to General Paper Mill Slime Control," by J. R. Sanborn, National Aluminate Corp., Chicago, Ill.

2. "A New Method for Detecting Slime in Pulp and Paper Mills," by Stanley J. Buckman and Virginia Henington, Buckman Laboratories, Memphis, Tenn.

3. "Pink Slimes in Paper Mills — Identification and Control of Causative Organisms," by John W. Appling, N. Jean Ridenaur, and Stanley J. Buckman, Buckman Laboratories, Memphis, Tenn.

4. Paper by Ernest Reed, Syracuse University, Syracuse, N. Y.

5. Paper by representative of the Dow Chemical Co., Midland, Mich.

2:00 p.m. Acid Pulping (West Ball Room)

John M. McEwen, Pulp Div., Weyerhaeuser Timber Co., Everett, Wash., chairman.

1. "Commercial Sulphite Experience With Ammonia Base," by L. A. La Fond and W. F. Holzer, Crown Zellerbach Corp., Lebanon, Ore., and Camas, Wash., respectively.

2. "Chemical Reaction Equilibria in Calcium and Magnesium-Base Sulphite Recovery Systems," by Roy P. Whitney, Richard M. Elias, and Malcolm N. May, Institute of Paper Chemistry, Appleton, Wis.

3. "The Program of the Sulphite Pulp Manufacturers' League," by Averill J. Wiley, SPMRL, Appleton, Wis.

4. "The Determination of Solids in Sulphite Liquor," by a member of the Acid Pulping Committee.

5. "The Sulfur Process," by R. S. Aries and Arthur Pollak, R. S. Aries Associates, New York, N. Y.

2:00 p.m. Paper Making (Cylinder) (East Ball Room)

J. J. Harrison, Michigan Carton Co., Battle Creek, Mich., chairman.

Panel discussion on "Wet-End Problems and Operation of Cylinder Machines."

1. "Instrumentation and Control," by A. T. Luey, Sutherland Paper Co., Kalamazoo, Mich.

2. "Air Prevention and Elimination in Stock to the Vats," by representative of the Ohio Boxboard Co., Rittman, Ohio.

3. "Wire Marks — Their Cause and Means of Elimination," by Glen T. Renegar, Container Corp. of America, Manayunk, Pa.

4. "The Mechanism of Stock Formation on a Cylinder," by Frank Hollis, Alton Boxboard Co., Alton, Ill.

2:00 p.m. Fibrous Agricultural Residues (Room A)

S. I. Aronovsky, Northern Regional Research Laboratory, Peoria, Ill., chairman.

1. Paper on the preservation of straw.

2. Paper on bamboo, by representative of the New York State College of Forestry, Syracuse, N. Y.

3. "Mechano-Chemical Pulping—Reaction Rates," by representative of Northern Regional Research Laboratory, Peoria, Ill.

4. "Boxboard from Wheat Straw to Replace Wood Veneer in Wire-Bound Shipping Containers," by E. C. Lathrop, T. R. Naffziger, and Earl R. Stivers, Northern Regional Research Laboratory, Peoria, Ill.

5. "Agricultural Residue Pulps — Crotalaria Pulps," by A. J. Ernst, H. M. Sutcliffe, and S. I. Aronovsky, Northern Regional Research Laboratory, Peoria, Ill.

AMERICAN PAPER AND PULP ASSOCIATION'S PAPER PRODUCTION RATIO REPORT

(Production as per cent of normal capacity)

COMPARATIVE WEEKLY SUMMARIES

	Dec. 16	Dec. 23	Dec. 30	Jan. 6, 1951	Jan. 13
1950	100.6‡	97.3‡	67.3‡	95.0r	100.9
	Dec. 17	Dec. 24	Dec. 31	Jan. 7, 1950	Jan. 14
1949	*98.7*	*87.9*	*72.7*	*88.2*	*93.9*

COMPARATIVE MONTHLY SUMMARIES

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1950	*92.6*	*95.6*	*96.7*	*93.4*	*96.4*	*97.7*	*83.3‡*	*100.3‡*	*96.2‡*	*101.2‡*	*100.3‡*	*93.7‡*	*92.9‡*
1951													

‡ Preliminary.

COMPARATIVE YEARLY SUMMARIES

	1944	1945	1946	1947	1948	1949	1950	1951
Year to Date								
Year Average	88.1	89.4	100.1	104.3	96.2	88.6	92.9‡	

PAPERBOARD OPERATING RATIOS†

	Dec. 16	Dec. 23	Dec. 30	Jan. 6, 1951	Jan. 13
1950	103	105	63	91	106
	Dec. 17	Dec. 24	Dec. 31	Jan. 7, 1950	Jan. 14
1949	*92*	*92*	*53*	*74*	*94*

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Avg.
1950	88	92	91	92	91	94	82	100	96	102	101	95	94
1951													

All of the above data is based on tonnage reported to American Paper and Pulp Association. Does not include mills reporting to National Paperboard Association, except in isolated cases where both paper and paperboard are produced and separate tonnage figures are not readily available. Does not include mills producing newsprint exclusively.

Note: The chart shows the ratio through December 1950 on the basis of 6-day capacity. Beginning with January 1951 the ratio is shown on the new basis of normal 6- and 7-day capacities. Corresponding weekly and monthly ratios for 1950 on the new basis, shown in the tables above, are somewhat lower.

Paperboard operating ratios continue on the basis of a 6-day week.

† Per cents of operation based on "inch-hours" reported to the National Paperboard Association.

THURSDAY, FEBRUARY 22, 1951

9:00 a.m.—Mechanical Pulping (Room B-C)

F. W. O'Neil, New York State College of Forestry, Syracuse, N. Y., chairman.

1. "Hydrogen Peroxide Bleaching of Chemical and Mechanical Pulps," by R. L. McEwen, F. R. Sheldon, and D. H. Nelson, Buffalo Electro-Chemical Co., Inc., Buffalo, N. Y.

2. "Peroxide Bleaching of Groundwood and Sulphite Pulps," by R. A. Premo, Gould Paper Co., Lyon Falls, N. Y.

3. "Color Removal of Process Water," by J. H. Davidson, Minnesota & Ontario Paper Co., International Falls, Minn.

4. "The Vibrotor Screen," by Sven Fahlgren, Bird Machine Co., So. Walpole, Mass.

5. "Effect of Recycling Spent Liquor in Semichemical Pulping," by E. L. Keller and J. N. McGovern, Forest Products Laboratory, Madison, Wis. (by title).

6. "Poplar Growth and its Utilization in Papermaking in Italy," by representative of Cartiera Burgo, Torino, Italy (by title).

9:00 a.m.—Microscopy (Room A)

C. E. Brandon, Howard Paper Mills, Inc., Dayton, Ohio, chairman.

1. "Routine Fiber Analysis of Pulps, Papers and Paperboards," by Norval F. Wilson, Alton Box Board Co., Alton, Ill.

2. "An Optical Projection Method for Measuring Fiber Length," by Thomas Fyfe, Eastman Kodak Co., Rochester, N. Y.

3. "The Microscopy and Identification of Snythetic Fibers," by F. D. Houghton, American Viscose Corp., Marcus Hook, Pa.

4. "The Microscopic Identification of Paper Fillers," by Harold C. Koch, C. Edwin Brandon, and Kenneth P. Geohegan, Howard Paper Mills, Inc., Dayton, Ohio.

5. "Some Unconventional Uses of the Microscope on Wood and Its Fibrous Products," by T. G. Rochow, American Cyanamid Co., Stamford, Conn.

6. "A Proposed Card Sorting System for the Identification of Pulpwoods," by B. Francis Kukachka, Forest Products Laboratory, Madison, Wis. (by title).

9:00 a.m. Graphic Arts (West Ball Room)

Fred D. Elliott, Time, Inc., Chicago, Ill., chairman.

Methods of Testing Symposium.

1. "Measuring Printing Quality of Magazine Paper," by Emery Braugh, Time, Inc., New York, N. Y.

2. "Numerical Evaluation of Printability of Paperboard," by Clyde Eckhart, Ohio Boxboard Co., Rittman, Ohio.

3. "Measuring Printing Quality of Newsprint," by Gerard Larocque, News Syndicate Co., New York, N. Y.

4. "Development of a Test for Evaluating the Bonding Strength of Coated Papers," by W. W. Roehr, Kimberly-Clark Corp., Neenah, Wis.

1:00 p.m. Annual Luncheon (Grand Ball Room)

A. E. Bachmann, presiding.

1. Presentation of the TAPPI Medal to George H. Tomlinson, Howard Smith Paper Mills, Montreal, P. Q., by J. N. Stephenson, Pulp and Paper Magazine of Canada, Gardenvale, P. Q.

2. "The International Situation," by J. D. Zellerbach, Crown Zellerbach Corp, San Francisco, Calif.

APPOINT LESLIE CLEMINSON

OTTAWA—Leslie Cleminson has been appointed general manager of British Columbia Pulp & Paper Co., Ltd., with headquarters in Vancouver, B. C.

H. GOLDMAN & SONS

CONVERTERS OF PAPER, now offer the Paper Jobbers and Converters the use of their new and greatly enlarged converting equipment. This new equipment can handle rolls for slitting or rewinding that trim up to 84" in width. The sheeting equipment can accommodate rolls up to 100" in width and can be cut to any desired length up to 165". The daily output of the plant is approximately 125 tons.

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DURO —our standard returnable paper mill core of plus-standard quality.

EN-DURO —a super-quality core to meet demands for extra strength and service.

RHINO

NON-RETURNABLE —an extremely tough and strong core with a low cost that meets the market for a standard product giving superior service.

Sonoco also makes paper cores for other uses. Your inquiry is invited.

SONOCO PRODUCTS COMPANY

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- Design & Construction of Pulp and Paper Mills
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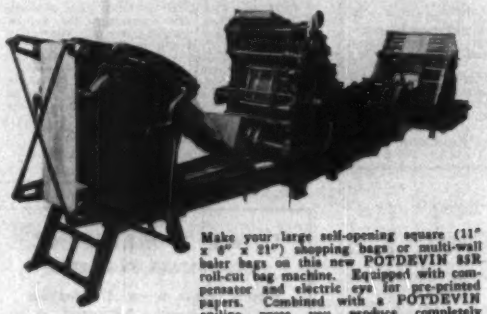
High Speed, Low Cost Production with the new

POTDEVIN

SELF-OPENING SQUARE SHOPPING AND BALER BAG MACHINE



Make your large self-opening square (11" x 6" x 21") shopping bags or multi-wall baler bags on this new POTDEVIN 85R roll-cut bag machine. Equipped with compensator and electric eye for pre-printed papers. Combined with a POTDEVIN aniline press you produce completely printed bags in one operation. Can be equipped with "bile" punching and scoring for string handles. Available with either upright or inverted former for sift-proof bags.

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SUPERCALENDERED	ENVELOPE
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POSTER	TAG
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WRITING	MACHINE COATED

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EXCELSIOR KNOX Woolen Co. Camden Me. FELTS & JACKETS

"EXCELSIOR" FELTS

The Trademark of Felts of Superior Quality for Every Grade of Pulp and Paper

KNOX WOOLEN COMPANY

CAMDEN, MAINE

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MEN WANTED
POSITIONS OPEN

We can place—bag factory superintendent; foreman and supt. for coating depts.; plant engineers and asst. plant engineers; designers; draftsmen; mechanical engineers; Fourdrinier and Cylinder machine foremen; training supervisors.

Chemists and chemical engineers; architects and architectural draftsmen; master mechanics; man to put clothing on paper machines; time study engineers; cost accountants; salesmen to sell mechanical equipment, chemicals, etc.; electrical engineers (foremen) for mills in So. Amer. and Canada; leather engineers; machine tenders, back tenders and third hands.

LIST YOUR CONFIDENTIAL APPLICATION WITH US

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CHARLES P. RAYMOND SERVICE, Inc.
294 Washington St., Boston 8, Mass.
SPECIALISTS IN PLACING PULP AND PAPER MILL EXECUTIVES
J-26

Chemist — Young man or woman college graduate with coating mill laboratory experience preferably with knowledge of colloids and adhesives to assist in paper development work in lithographic industry in Midwest. Our employees know of the opening. Send complete resume, Box 51-33, care Paper Trade Journal. P-16

EXCELLENT OPPORTUNITY FOR POWER PLANT SUPERINTENDENT with paper mill experience. Mechanical or electrical college engineering degree preferred but not required. Must be aggressive, energetic, and a capable handler of men. Age preferred 30 to 50. State complete details of experience, availability, and salary desired. Address box 51-35, care Paper Trade Journal. J-26

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Paper converting, nationally known. Printing, coating, gumming, laminating, finishing operations. Lifetime position for top-flight production executive. Our people know of this ad. Send full details confidentially to President, Box 50-443, care Paper Trade Journal. TF

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A
WORKING SUPERINTENDENT
and a
MASTER MECHANIC
wanted in New Jersey.
Cylinder Machine.
Address Box 51-18 care Paper Trade Journal.
J-26

WANTED — SALES ENGINEER — Experienced in Pulp and Paper Mills, for sales and service work. Excellent opportunity with old established machinery manufacturer. In reply, give resume of education, experience and current salary. Address Box 50-513 care Paper Trade Journal. TF

HELP WANTED

WORKING SUPERINTENDENT for small, fast growing Eastern mill making lightweight specialties. Cylinder machine experience essential. State qualifications and salary expected. Address Box 50-378 care Paper Trade Journal. TF

ENGINEERING DRAFTSMEN. Need two for old established well known machinery manufacturer located in North Central Wisconsin. Paper machinery background valuable. Excellent opportunity. Permanent. State qualifications and salary expectations in first letter. Address Box 51-24 care Paper Trade Journal. J-26

INSTRUMENT MAINTENANCE MAN to work with one of two assistants. New plant. South Atlantic coastal. Excellent opportunity. Begin about May 15th. Address Box 51-21 care Paper Trade Journal. J-26

WANTED—MASTER MECHANIC for one machine mill making Folding Grades. Good salary and good working conditions. Contact R. E. STEARNS, Empire Box Corp., of Stroudsburg, P. O. Box 54, Stroudsburg, Pennsylvania. F-2

WORKING SUPERINTENDENT for small napkin converting plant. Knowledge of printing essential. State salary, experience, etc. Address Box 51-4 care Paper Trade Journal. J-26

WANTED—Specialty Paper Mill Master Mechanic for Mid-western mill. Age 40 to 50 years with engineering background. In reply state qualifications and give references. Address Box 51-27 care Paper Trade Journal. F-16

TOUR BOSS with experience in producing lightweight papers, such as manifold and onionskin. Mill located in Massachusetts. In reply give full details, including salary expected. Address Box 51-39 care Paper Trade Journal. F-9

SITUATIONS WANTED

MILL SUPERINTENDENT with proven ability in conventional or Yankee Fourdrinier Mill manufacturing light or heavy weight Kraft or sulphite specialty grades. Desires new connection. Address Box 51-14 care Paper Trade Journal. F-2

PLANT MANAGER—Manufacture and conversion of boards and papers; wants change for greater opportunity. Competent and successful in organization; production; and labor relations. Address Box 50-931 care Paper Trade Journal. J-26

KRAFT PULP MILL MAN IS AVAILABLE NOW WHO HAS YEARS OF SUCCESSFUL PRODUCTION AND TECHNICAL CONTROL EXPERIENCE. ANYONE INTERESTED PLEASE ADDRESS BOX 51-7 care Paper Trade Journal. J-26

TECHNICAL AND PRODUCTION CONTROL. Party newly arrived in this country seeks connection. Broad experience in Kraft, Sulphite and Groundwood Pulps and Papers. Best references. Address Box 51-26 care Paper Trade Journal. F-2

MILL ENGINEER—available soon; knowledge Fourdrinier specialty and cylinder machines; tech. Graduate; sulphite pulp and paper mill design and plant engineering experience. Address Box 51-30 care Paper Trade Journal. J-26

FOREMAN with many years practical experience converting papers for all purposes, desires connections with reliable concern. Middle aged. Can handle help for best results. Address Box 51-31 care Paper Trade Journal. F-2

TECHNICAL GRADUATE—B.S., M.S. New York State College of Forestry 1½ years experience Quality Control and Development Work with Absorbent Specialty Mill. Seeks change for greater opportunity. Address Box 51-37 care Paper Trade Journal. F-2

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TECHNICAL DIRECTOR

Proven experience in practical methods of paper manufacturing, converting, printing & quality control. Beat; fibre & loft; coatings; gumming; pasteing grades and waxing, from the laboratory through production. Fifteen years of co-ordinated work in the above fields. Will consider Technical Sales in a progressive development program. Address Box 51-34, care Paper Trade Journal. F-2

FOR SALE

FOR SALE

Supercalender — One modern right-hand 94" eleven roll web Norwood stack, speed range 50 feet to 2,000 feet per minute with automatic weighting control capable delivering one ton per lineal inch bottom nip. All rolls equipped with anti-friction bearings. Reliance variable speed drive with MG sets, driven by synchronous motor wound for 3 phase, 60 cycle, 2300 volts. Reply Box 51-22 care Paper Trade Journal. F-2

FOR SALE

Sulphate pulp plant. Capacity about 35 tons. Box Number 51-23, care Paper Trade Journal.

J-26

COMPLETE
SUBJECT TO PRIOR SALE

96" Trim Machine, including:
Brownell Engine (new parts, overhauled, like new), Three (3) beaters (with motors) Stock Chest (with motors and agitators) Three (3) Noble and Wood Jordans (with motors), Piping, Mixing Boxes, Three (3) Primary Presses, Three (3) Secondary Presses, Complete Felt Section, including Gilbert and Nash Guides, Broughton Showers, Two (2) Calender Stacks (Sandy Hill nine roll stack and Farrel Birmingham nine roll stack), One (1) Downingtown Duplex Shooter complete with drive, all drives for complete paper machine are Bagley and Sewall Bevel Gears. Complete line shaft, including hangers, bearings and pulleys, Two complete sets extractor rolls, air ducts and piping.

Extra spare Felt Rolls, Extra Primary Press Rolls, Extra Secondary Press Rolls.

This machine may be equipped for either a Cylinder or Fourdrinier type machine.

We have on hand many auxiliary and spare parts for this equipment, including pumps, motors, piping, valves, wiring, electrical equipment etc. Auxiliary equipment too numerous to mention.

We have everything for the complete machine, with the exception of screens, dryers and wet end.

This can be inspected by appointment only, ask for Mr. Arthur Alcombrack, telephone Hoosick Falls 90. Will sell very cheap, package deal.

Thomas A. Guiasto and Sons, Inc.
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TF

FOR SALE—One two color paper converter, napkin machine. Machine in perfect condition. Can be seen in operation. Priced right. Address Box 51-38 care Paper Trade Journal. J-26

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CURRENT OFFERINGS

32" model 24-3A and 42" model 6 Cameron Slitters.
45" Beck Sheeter with layboy.
58" Finley Sheeter.
82" Hamblet Sheeter, only 8 yrs. old.
100" Horne single knife Sheeter.
68" Oswego mill type Power Cutter, with power back guage.

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FOR SALE

FOR SALE

1—9 roll—67" wide face Holyoke Machine Co.'s stack of supercalenders, good operating condition, complete with drive, less motors and starting equipment. Address Box 51-25 care Paper Trade Journal. J-26

FOR SALE: Form 246 M, Kerr Steam Turbine, direct connected to Generator, 300 KVA, 3 phase, 480 volts, 3600 RPM, Allis Chalmers generator and exciter. Non-condensing turbine, 400 H.P., 3600 RPM when operating on 120 lb. gauge initial pressure. Immediate delivery. Will sell reasonable. Reply Sangamon Paper Mills, 137 W. Pershing Road, Chicago (9), Illinois. J-26

FOR SALE—64" Seybold Paper Cutter; 36" Beck and 48" Kidder Sheeters; 6" Brightwood; 26" x 38" Thomson Platen Die Cutters; also Paper Box, Container, and Paper Converting Machines of all standard makes and sizes. Write for listing. Address Box 51-19, care Paper Trade Journal. TF

FOR SALE

FOR SALE

2—84" 9-roll Supercalender Stacks. Complete with drives.

J. J. ROSS COMPANY
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Tel. Bigelow 3-3720 J-26

FOR SALE

4—Shartle Brothers Circulating Pumps, each 4000 g. p. m.

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Tel. Bigelow 3-3720 J-26

#2—Two Moore & White Screens both in operation until late November, 1950. Scott Paper Co., Chester, Pa., Attention E. W. Broomall. J-26

FOR SALE—5 Globe Rotaries, 14 ft. diameter, will sell cheap. Reply to Sangamon Paper Mills, Inc., 137 W. Pershing Road, Chicago, 9, Ill. J-26

FOR SALE

1—112" Cameron, Type 18, 40" rewind.
1—400 h.p. Synchronous motor, 450 r.p.m.
1—350 h.p. Slip ring motor, 400 r.p.m.
1—125 h.p. Synchronous motor, 600 r.p.m., 550 v. (Late model).

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1—1½ lb. Laboratory Beater.
1—660 lb. Beater—iron tub.
1—Ditto Iron Tub Laboratory Beater. Beater roll 14" diameter x 10¼" face, including motor.

CALENDER STACKS
1—72" 5 roll Calender Stack.
1—3 roll pressure calender—32" x 108".
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1—90"—3 roll.

CHIPPER
1—84" Murray 4 knife Chipper—anti-friction bearings.

CRUSHER & HAMMERMILL
1—Murray Chip Crusher.
1—Jeffrey Hammermill.

CYLINDER MOLDS
1—39" diameter x 72" face.
1—38" diameter x 79" face.
5—36" diameter x 54" face.
1—48" diameter x 117" face.
1—38" diameter x 96" face.
1—49" diameter x 72" face.

DIGESTERS
3—14 ft. Rotary Digesters.

DRIVES
1—#6½ Reeves Drive.
1—#4 Reeves Drive
1—Reliance Electric Drive, complete with 5 gear head motors.
2—#3 Reeves Drives (totally enclosed).

V-BELT DRIVE
1—21½" diameter x 7½" face, 5 groove.
1—16½" diameter x 7½" face, 5 groove. (With clutch).

DRYERS
1—Complete unit, consisting of 6 dryers, 36" diameter x 38" face, including frames, gears, anti-friction bearings.
8—Copper faced Dryers 60" diameter x 72" face, including frames, gears, etc.
7—24" diameter x 48" face.
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1—48" diameter x 91" face.
3—36" diameter x 96½" face.
1—36" diameter x 145" face.
1—24" diameter x 130" face.
1—48" diameter x 70" face.
2—48" diameter x 92" face.
1—48" diameter x 82" face.
12—36" diameter x 70" face—complete with bearings, gears & frames.
3—Dryers 48" diameter x 134" face.
1—36" diameter x 84" face.
1—24" diameter x 94" face.
3—28" diameter x 48" face.

FELT CONDITIONER
1—149" Nash Felt Conditioner.

FLAT SCREENS
1—6 stage Shartle Flat Screen
7—Packer, 12 plate, roller shoe type.

FRAMES
Vertical frames for 100 dryers, 48" diameter, with bearings.

JORDANS
1—Horne Jordan.
2—Noble & Wood Mammoth.

LIME SLUDGE FILTERS
2—IMPCO Lime Sludge Filters, vacuum type, 8' diameter x 4' face.
2—IMPCO Lime Sludge Filters, vacuum type, 8' diameter x 10' face.

MISCELLANEOUS
1—Caustic Mixer.

MOTORS
1—125 h.p., 1700 r.p.m.
1—50 h.p., 850 r.p.m.
Write us regarding your requirements.

PRESSES
3—Sets Primary Presses, complete, 145" face. Anti-friction bearings. Also all types of rolls for 148" wet end.

PULLEYS
Various cone and assorted pulleys.

PULP BALER
1—200 ton hydraulic Pulp Baler. (Practically new).

PULPERS
1—Jones Pulper. Complete with motor and drive.
1—Noble & Wood Pulper—Iron Tub.

PULP PRESSES
2—Pulp Presses 78" wide (Kamyr Type).

PUMPS
Various sizes of Centrifugal and Plunger Pumps. Write us regarding your particular requirements.

REEL
1—104" Beloit two bowl reel.

REFINERS
2—Claflin Refiners.

ROLLS
Felt, Table, Press, Breast, Couch, etc. Various sizes and types. (Bronze, Rubber, Iron, etc.)

ROTARY SCREENS
1—#2 Bird Rotary Screen.
1—#2A Bird Rotary Screen.
3—#2A Cylinders, only (for Bird Rotary Screens). (Chrome plate).

SHEETERS
3—36" Sheeters.
3—46" Sheeters.
2—56" Sheeters.
1—44" Hamblet Sheeter, rebuilt.
2—64" Hamblet.

SHREDDERS
3—Daniels Rag Cutters.
1—Taylor-Stiles Giant Shredder, portable.
3—Pulverizers.

SLITTERS & WINDERS
1—42" Cameron—Type 40-4-B
2—42" Cameron—Type 24-2-A.
1—42" Cameron—Type 8-S.
1—113" 2 drum Waldron
2—112" Cameron—Type 18.
1—104" Beloit two drum winder.
1—42" Cameron Constant Tension with pneumatic control.
1—42" Cameron—Type 6.
1—82" Cameron—Type 8-S.
1—42" Cameron—Type 24-3A.
1—62" Cameron—Type 26-3A.

STOCK PUMPS
1—10 x 20 Shartle Duplex.
1—7 x 16 Shartle Duplex.
1—7 x 16 Shartle Triplex.
1—10 x 20 Shartle Triplex.
Advise as to your requirements.

SUCTION BOXES
5—Suction Boxes, 62" drilled face x 6" wide.

SUCTION COUCH ROLL
1—Sandusky 14.5" dia. x 103" drilled face.

VACUUM PUMPS
1—#3 Nash Hytor.
1—#1 Nash Hytor.

VAT
1—Iron end Vat only, for decker or savall. suitable for cylinder mold 36 x 120.

WAXING MACHINES
1—48" Potdevin Waxing Machine.

We are always in the market to purchase your surplus or idle machinery. What have you to offer? Wanted Cylinder and Fourdrinier Machines (complete mills).

Paddy Ross, Pres. **J. J. ROSS COMPANY** **Ben Kurz, Treas.**
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WANTED

PAPER — ALL KINDS — TISSUE, GLASSINE AND CELLOPHANE

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J-26

WANTED WAXING MACHINE

State particulars. Contact Bleyco Paper Corp., 419 West 55th Street, New York 19, N. Y.

Telephone PLaza 7-6380.

J-26

WANTED

Press Rolls 96" to 98" Face, 17" to 19" O.D. with or without Rubber Covering.

Address Box 51-32, care Paper Trade Journal.

F-2

WANTED—Brightwood Box Machine, Shredders, Evaporators, Generators and Boilers, Slitters, Cutters, Hydraulic presses, Sheridan Presses, Dryers. Address Box 50-193 care Paper Trade Journal. TF

WANTED

CELLOPHANE WANTED

Will pay $1.20 lb. delivered. Rolls 12½" to 15" wide—#300, #400, #450 MST and HS from your surplus allotment stock. Box 5-36 care Paper Trade Journal. J-26

WANTED—USED MOTORS

2—150 or 175 H.P., 440 volt, 3 phase, 60 cycle, 450 RPM motors, including starting compensators and contactor boards. Exciters not needed.

OR

2—175 H.P. squirrel cage 440 volt, 3 phase, 60 cycle, 450 motors, with starting compensators.

We can offer for sale or exchange two 550 volt motors to be released after purchase and installation of the 440 volt motors. Further details on request. In replying please give full information on 440 volt motors including price. Reply Box 50-604 care Paper Trade Journal. F-2

WANTED

Side-runs paper from basis 60-lb. to 120-lb. in rolls 6½" or wider, large diameter, in Book, Kraft, Groundwood-White, Pastel or Light Colors.

J. F. AUER, INC. MAMARONECK, N. Y. J-26

WANTED—W & P Shredders, Evaporators Generators and Boilers, Slitters, Cutters Hydraulic presses, Sheridan Presses, Dryers. Address Box 50-18 care Paper Trade Journal. TF

WANTED

WANTED

Serviceable Grocery Bag Machine 8 through 20 lb. sizes. Recent Model Potdevin preferred.

Address Box 50-450, care Paper Trade Journal. TF

WANTED

To Purchase Paper Mill

Have pulp available. Can pay cash.

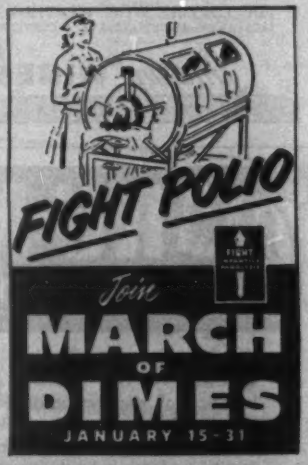
BOX #51-29 care Paper Trade Journal. F-2

TOP & BOTTOM SEALER

and compresser with adequate metering for cartons size 17⅝" x 17⅝" x 18¼" high.

SCOTT PAPER CO.
Chester, Pa.
Attention: Mr. E. Broomall

WANTED—3 Wet Lap Machines, 84" face, primary press, Lapping Press. Address Box 51-28 care Paper Trade Journal. J-26



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for both large and small

PAPER MILLS

Capacities from one to five tons an hour.

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BUY U. S. SAVINGS BONDS

MISCO
STAINLESS STEEL CASTINGS
for all equipment exposed to corrosion by sulphite acids or other corrosive agents
MICHIGAN STEEL CASTING CO., DETROIT 7, MICH.

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BUILT - REBUILT - RECONDITIONED

Building the finest calender and embossing rolls to your specifications is a Wheeler specialty—backed by 20 years experience. Calender and embossing rolls up to 240 inches built or reconditioned. Complete technical department at your service.

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APPLETON FELTS
for Dryer and finish

APPLETON WOOLEN MILLS APPLETON, WISCONSIN

It's a long way back over the years to the cumbersome, bulging valise of the gay, uncomfortable nineties. Over that stretch, also, the quality of Fourdrinier wire cloth and its product, paper, has immeasurably improved. Lindsay takes pride in the contributions it has made in these fields.

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Lindsay WIRES

Cowles NU-NAP
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Cowles NU-NAP contains a new combination of products and a brand new idea in detergent action. NU-NAP does an outstanding washing job on paper machine felts — both on and off the machine. NU-NAP will give extra life to your felts—it leaves them unusually clean—fluffy and absorbent.

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WHERE TO BUY

ABRASIVES
Monsanto Chemical Co.
Norton Co.

ADHESIVES
American Cyanamid Company
Plastics & Resins Division
E. I. Du Pont De Nemours & Co., Inc.
The Goodyear Tire & Rubber Company
Monsanto Chemical Co.
Morningstar, Nichol, Inc.
National Starch Products, Inc.
Nopco Chemical Co.
Stein, Hall & Co., Inc.

AGITATORS
American Paper Machy. & Engrg. Works, Inc.
Appleton Machine Co.
The Cowles Company
Dilts Machine Works, Inc.
Dorr Company
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
D. J. Murray Mfg. Co.
Moore & White Co.
The Sandy Hill Iron & Brass Works
Valley Iron Works Co.
Shartle Brothers Machine Co.

ADJUSTABLE SHAKE MOTION
Manchester Machine Co.

ADJUSTABLE TILTING MOTOR BASE
Lovejoy Flexible Coupling Co.

ALLOYS
Michigan Steel Casting Co.

ANTIFOAM
American Cyanamid Company
Industrial Chemicals Division
National Aluminate Corp.
Nopco Chemical Co.

APRON CLOTH
Williams-Gray Co.

BAG MACHINES
Dilts Machine Works
Potdevin Machine Co.
The Sandy Hill Iron & Brass Works
Smith Winchester Mfg. Co.
Weber, Herman G., & Co., Inc.

BALL MILLS
F. L. Smidth & Co.

BARK BURNER
Nichols Engrg. & Research Corp.

BARKERS AND CHIPPERS
Allis-Chalmers Mfg. Co.
Appleton Machine Co.
Carthage Machine Co.
D. J. Murray Mfg. Co.
Valley Iron Works Co.

BARS
Dilts Machine Works
E. D. Jones & Sons Co.
The Moore & White Co.
Shartle Brothers Machine Co.
Valley Iron Works Co.

BASIC WEIGHT SCALES
Thwing-Albert Instrument Co.

BEARINGS
Black Clawson Company
E. D. Jones & Sons Co.
Link Belt Company
Magnus Metal Corp.
The Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
SKF Industries
Stephens-Adamson Mfg. Co.
Timken Roller Bearing Co.
Valley Iron Works Co.

BEATERS AND JORDANS
American Paper Machy. & Engrg. Works, Inc.
The Appleton Machine Co.
Black Clawson Company
Dilts Machine Works
Downingtown Mfg. Co.
E. D. Jones & Sons Co.
Morden Machines Co.
J. J. Ross Company
Ross Paper Machy. Co.
Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.

BED PLATES
Buhr Brothers Mfg. Co.
Dilts Machine Works, Inc.
Downingtown Mfg. Co., Inc.
Farrel-Birmingham Co., Inc.
E. D. Jones & Sons Co.
Lukenweld Div., Lukens Steel Co.
Shartle Brothers Machine Co.
Valley Iron Works Co.

BELTING
Allis-Chalmers Mfg. Co.
Goodrich, B. F., Co.
The Goodyear Tire & Rubber Company
Link Belt Company

BIN DISCHARGERS
Stephens-Adamson Mfg. Co.

BLEACHING AGENTS
E. I. Du Pont De Nemours & Co., Inc.
General Dyestuff Corp.
Rohm & Haas Co.
Virginia Smelting Co.

BLEACHING APPARATUS
E. D. Jones & Sons Co.
Perkins & Sons, Inc., B. F.
Moore & White Co.
Niagara Alkali Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

BLOW PIPES & PITS
Carthage Machine Co.
Kalamazoo Tank & Silo Co.
Moore & White Co.
Murray Mfg. Co., D. J.
Walworth Company

BOILERS
Babcock & Wilcox Co.

BOTTOMS
Kalamazoo Tank & Silo Co.
Valley Iron Works Co.

BOXBOARD SCALES
Thwing-Albert Instrument Co.

BRUSH ROLLS
M. W. Jenkins Sons, Inc.

BRUSHES
M. W. Jenkins Sons, Inc.
Gus Reisel & Son

BURSTING TESTERS
B. F. Perkins & Son Inc.
Testing Machines, Inc.

CALENDERS
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Downingtown Mfg. Co.
Farrel-Birmingham Co., Inc.
Lobdell Co.
Edward J. McBride
The Moore & White Co.
Perkins & Sons, Inc., B. F.
J. J. Ross Company
Ross Paper Machy. Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.
Waldron Corp., John

CARRIER ROPE
Williams-Gray Co.

CASEIN
American Cyanamid Co.
Industrial Chem. Div.
Bunge Pulp & Paper Co.
Hercules Powder Co.

CASTINGS
Appleton Machine Co.
Black Clawson Company
Babcock & Wilcox Co.
Carthage Machine Co.
Dilts Machine Works
Downingtown Mfg. Co.
Farrel-Birmingham Co.
Hamblett Machine Co.
Hardinge Company, Inc.
Lobdell United Co.
Magnus Metal Corp.
Michigan Steel Casting Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.
Walworth Company

CENTRIFUGAL MACHINERY
Bird Machine Co.
Nichols Engrg. & Research Corp.
Ross, J. O., Engrg. Co.
Shartle Brothers Machine Co.

CHAINS
Link Belt Company
Stephens-Adamson Mfg. Co.

CHEMICAL COTTON PULP
Hercules Powder Co.

WHERE TO BUY

CHEMICALS
American Cyanamid Co., Industrial Chem. Div.
Ansul Chemical Co.
Bunge Pulp & Paper Co.
Calco Chemical Co.
Calgon, Inc.
Cowles Chemical Company
Dow Chemical Company
E. I. du Pont de Nemours & Co., Inc.
General Dyestuffs Corp.
Geigy Co., Inc.
B. F. Goodrich Chemical Co.
Gotlesman & Co.
Hercules Powder Co.
Hooker Electrochemical Co.
The Kinsley Chemical Company
Monsanto Chemical Company
National Aluminate Corp.
Niagara Alkali Company
Nopco Chemical Co.
Pittsburgh Plate Glass Co., Columbia Chemical Division
Rohm & Haas Co.
Virginia Smelting Co.
Wyandotte Chemicals Corp., Michigan Alkali Div.

CHESTS
E. D. Jones & Sons Co.
Kalamazoo Tank & Silo Co.
Shartle Bros. Mch. Co.

CLEANING MATERIALS
American Cyanamid Company Industrial Chemicals Division
Cowles Chemical Company
The Dow Chemical Company
E. I. du Pont de Nemours & Co., Inc.
General Dyestuff Corp.
Monsanto Chemical Company
Nopco Chemical Co.
Pittsburgh Plate Glass Co
Wyandotte Chemicals Corp., J. B. Ford Division

CLUTCHES
Appleton Machine Co.
Black Clawson Company
Farrel-Birmingham Co.
Hudson Sharp Machine Co.
Link Belt Company
Moore & White Co.
D. J. Murray Mfg. Co.
The Sandy Hill Iron & Brass Works
Shartle Bros. Mch. Co.
Stephens-Adamson Mfg. Co.

COATING MACHINERY
Dilts Machine Works
Frank W. Egan & Co.
Gibbs-Brower Company, Inc.
Hudson Sharp Machine Co.
The Mayer Machine Co., Inc.
Moore & White Co.
Pendervin Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Waldron Corporation, John Weber, Herman G., & Co., Inc.

COATING MATERIALS
American Anode Div.
American Cyanamid Company Industrial Chemicals Division
E. I. Du Pont De Nemours & Co., Inc.
B. F. Goodrich Chemical Co.
The Goodyear Tire & Rubber Company
Hercules Powder Co.
J. M. Huber Corp.
Monsanto Chemical Company
National Wax Co.
Nopco Chemical Co.
Wyandotte Chemicals Corp., Michigan Alkali Div.

COGS
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COMPLETE FOURDRINIER ROLL GRINDING
Manchester Machine Co.

COMPRESSORS
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Nash Engineering Co.
Roots-Connersville Blower Corp.

CONDENSATE FILTERS
Hungerford & Terry, Inc.
The Permutit Company

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Bird Machine Company
DuZurik Shower Company
Paper & Industrial Appliances

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Ebasco Services
Frank W. Egan & Co.
Alvin H. Johnson & Co., Inc.
Main, Inc., Chas. T.
The Rust Engrg. Co.
Shartle Bros. Mch. Co.
J. E. Sirrine & Co.
John Waldron Corp.
H. G. Weber & Co., Inc.

CONTINUOUS DIGESTER
Paper & Industrial Appliances

CONTROLLERS
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The Brown Instrument Co.

CONTROLS
The Brown Instrument Co.
Johnson Corp.
Potrier Control Co.
Shartle Bros. Mch. Co.
Stickle Steam Specialties Co.

CONVERTING MACHINERY
Egan, Frank W., & Co.
John Waldron Corp.
Dilts Machine Works
Hudson-Sharp Machine Co.

CONVEYORS
Black Clawson Company
Industrial Brownhoist Corp.
Link Belt Company
Murray, D. J., Mfg. Co.
Ross Engineering Corp., J. O.
Shartle Brothers Mch. Co.
Stephens-Adamson Mfg. Co.

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Ekenas Paper Co.
Rodney Hunt Machine Co.
Smith & Winchester Mfg. Co.
Sonoco Products Co.

CORROSION RESISTANT
Amercoat Corporation

COTTON LINTER
Railway Supply & Mfg. Co.

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Farrel-Birmingham Co., Inc.
E. D. Jones & Sons Co.
Link Belt Company
Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Thomas Flexible Coupling Co.
Valley Iron Works
Waldron Corp., John

CRANES
Cleveland Crane & Engrg. Co
Industrial Brownhoist Corp.
Link Belt Company
Whiting Corp.

CURL TESTER
Thwing-Albert Instrument Co.

CUTTERS
Black Clawson Company
Dilts Machine Works
Gibbs-Brower Company, Inc.
Thomas W. Hall Co.
Harris-Seybold Co.
Moore & White Co.
Perkins & Son, Inc., B. F.
The Sandy Hill Iron & Brass
Taylor, Stiles & Co. Works
The Smith & Winchester Mfg Co.

CYLINDER MOULDS
Manchester Machine Co.

CYLINDERS
M. W. Jenkins Sons, Inc.
National Tube Co.

DAMPENERS
Perkins & Son, Inc., B. F.
Valley Iron Works Co.

DECKLE WEBBING
Williams-Gray Co.

DEFIBRATORS
American Defibrator Co.

DE-INKING
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Dilts Machine Works
General Dyestuff Corp.
Kinsley Chemical Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

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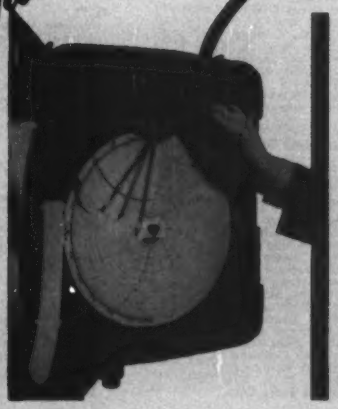

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Hungerford & Terry, Inc.
The Permutit Company

DEMULSIFIERS
Wyandotte Chemicals Corp., Michigan Alkali Div.

DENSOMETERS
Bunge Pulp & Paper Co.
W. & L. E. Gurley

DESIGN CONSTRUCTION
Ebasco Services

DETERGENTS
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Calgon, Inc.
Cowles Chemical Co.
General Dyestuff Corp.
Monsanto Chemical Company
Nopco Chemical Co.
Rohm & Haas Co.
Wyandotte Chemicals Corp., Michigan Alkali Div.

DEWAXING CHEMICALS
American Cyanamid Company Industrial Chemicals Division
General Dyestuff Corp.
Nopco Chemical Co.

DIFFERENTIAL SCALES
Thwing-Albert Instrument Co.

DIGESTERS
Babcock & Wilcox Co.
Chicago Bridge & Iron Co.
Lukenweld
Pusey & Jones Corp.

DIGESTERS (Continuous)
Paper & Industrial Appliances

DISPERSING AGENTS
Calgon, Inc.
General Dyestuff Corp.
Monsanto Chemical Company
National Aluminate Corp.
Nopco Chemical Co.
Rohm & Haas Co.
Wyandotte Chemicals Corp., Michigan Alkali Div.

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Black Clawson Company
Downingtown Mfg. Co.
Lobdell United Co.
Ludding Engineering Corp.
The Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

DOCTOR BLADES
Bird Machine Company
Ludding Engrg. Corp.
The Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

DRIERS
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Downingtown Mfg. Co.
Gibbs-Brower Company, Inc.
Lukenweld
The Moore & White Co.
Murray Mfg. Co., D. J.
I. J. Ross Company
Red-Ray Mfg. Co., Inc.
Ross Paper Machy. Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Valley Iron Works Co.

DRILLED SUCTION COUCH ROLLS
Manchester Machine Co.

DRILLED SUCTION DRUM ROLLS
Manchester Machine Co.

DRIVES
Allis-Chalmers Mfg. Co.
Appleton Machine Co.
Bird Machine Co.
Black Clawson Company
Dilts Machine Works
Downingtown Mfg. Co.
Fairbanks, Morse & Co.
Farrel-Birmingham Co.
General Electric Company
Gibbs-Brower Company, Inc.
Rodney Hunt Machine Co.
Link Belt Company
Moore & White Co.
Murray, D. J., Mfg. Co.
Pusey & Jones Corp.
I. J. Ross Company
Ross Paper Machy. Corp.
The Sandy Hill Iron & Brass Works
Shartle Bros. Mch. Co.
Stephens-Adamson Mfg. Co.
Valley Iron Works Co.
Westinghouse Electric Corp.

DRUM WINDERS
Manchester Machine Co.

DRYER DRAINAGE
Stickle Steam Specialties Co.

DRYER ROLL PYROMETER
Thwing-Albert Instrument Co.

DUSTERS
Appleton Machine Co.
Downingtown Mfg. Co.
Frank W. Egan & Co.
M. W. Jenkins Sons, Inc.
E. D. Jones & Son Co.
Moore & White Co.
D. J. Murray Mfg. Co.
John Waldron Corp.

DUSTING BRUSHES
M. W. Jenkins Sons, Inc.

DYESTUFFS
American Cyanamid Company, Calco Chemical Div.
Bunge Pulp & Paper Co.
Ciba Company
E. I. du Pont de Nemours & Co., Inc.
Geigy Co., The
General Dyestuffs Corp.
National Aniline Division, Allied Chemical & Dye Corp.

ELECTRIC HYGROMETER
Thwing-Albert Instrument Co.

EMBOSSING MACHINES
Dilts Machine Works
Egan, Frank W., & Co.
John Waldron Corp.

EMBOSSING ROLLS
The Appleton Machine Co.
Gibbs-Brower Company, Inc.
Northern Engraving & Mch. Co.
B. F. Perkins & Son, Inc.
John Waldron Corp.
Wheeler Roll Co.

EMULSIFIERS
General Dyestuff Corp.
Nopco Chemical Co.
Rohm & Haas Co.
Wyandotte Chemicals Corp.

ENZYMES
Rohm & Haas Co.
Vanderbilt Co., R. T.
Wallerstein Co., Inc.

EVAPORATORS
Davis Engrg. Corp.
Goslin-Birmingham Mfg. Co., Inc.
Murray, D. J., Mfg. Co.
Swenson Evaporator Co., Div. of Whiting Corp.

EXPANDERS
Mount Hope Machinery Co.

FANS
General Electric Co.
B. F. Perkins & Son, Inc.
Ross Engineering Co., J. O.

FEEDERS
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The Permutit Company
Stephens-Adamson Mfg. Co.

FELTS
Appleton Woolen Mills
Asten-Hill Mfg. Co.
Draper Bros. Corp.
Huyck & Son, F. C.
Lockport Felt Co.
Morey Paper Mill Supply Co.
Shuler & Benninghofen
Waterbury Felt Co.
Waterbury, H., & Sons Co.
Williams-Gray Co.

FELT CLEANERS
Calgon, Inc.
Cowles Chemical Co.
General Dyestuff Corp.
Nopco Chemical Co.

FELT CONDITIONERS
Bird Machine Co.
The Sandy Hill Iron & Brass Works

FELT GUIDES
Black Clawson Company
Frank W. Egan & Co.
Gilbert & Nash Co.
Moore & White Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Waldron Corp., John

FILLERS
American Cyanamid Company, Industrial Chemicals Division
A. M. Meincke & Son, Inc.
Vanderbilt Co., R. T.
Wyandotte Chemicals Corp., Michigan Alkali Div.

FILTERS
Bird Machine Company
J. M. Huber Corp.
Hungerford & Terry, Inc.
Johnson Corp.
Moore & White Co.
J. O. Ross Engrg. Corp.
The Sandy Hill Iron & Brass Works
Walworth Company

FITTINGS
Crane Company
Shartle Bros. Mch. Co.
Walworth Company

FLEXIBLE COUPLINGS
Egan, Frank W., & Co.
Lovejoy Flexible Coupling Co.
John Waldron Corp.

FLOORING, GRATING AND TREADS
The Goodyear Tire & Rubber Company
Norton Co.

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Lukens Steel Co.
The Sandy Hill Iron & Brass Works

FORK LIFT TRUCKS
Clark Equipment Company, Industrial Truck Division
Towmotor Corp.

FORMATION TESTERS
Thwing-Albert Instrument Co.
Williams Apparatus Co., Inc.

FORMING MACHINES
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Downingtown Mfg. Co.
The Moore & White Co.
Noble & Wood Machine Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.

FREENESS TESTERS
Testing Machines, Inc.

GASKETS
The Goodyear Tire & Rubber Company

GEARS
Black Clawson Company
De Laval Steam Turbine Co.
Downingtown Mfg. Co.
Frank W. Egan & Co.
Farrel-Birmingham Co.
E. D. Jones & Sons Co.
Link Belt Company
Moore & White Co.
D. J. Murray Mfg. Co.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.
Westinghouse Electric Corp.
Western Gear Works

GRINDERS
Carthage Machine Co.
Farrel-Birmingham Co.
Gibbs-Brower Company, Inc.
Labbell Co.
Norton Company
Samuel C. Rogers and Company
The Sandy Hill Iron & Brass Works

GRINDING WHEELS
Norton Company

GUIDES
Egan, Frank W., & Co.
Gilbert & Nash Co.
The Moore & White Co.
Mount Hope Machinery Co.
John Waldron Corp.

GUMMING MACHINES
Dilts Machine Works
Egan, Frank W., & Co.
The Sandy Hill Iron & Brass Works

GUMS
National Starch Products, Inc.
Stein-Hall Co., Inc.

HEAT EXCHANGERS AND RECOVERY SYSTEMS
Davis Engrg. Corp.
Stickle Steam Specialties Co.
Westinghouse Electric Corp.

HEATING, VENTILATING & AIR CONDITIONING
The Appleton Machine Co.
Davis Engrg. Corp.
E. D. Jones & Sons Co.
General Electric Co.
D. J. Murray Mfg. Co.
Red-Ray Mfg. Co., Inc.
Ross Engineering Corp., J. O.
Stickle Steam Specialties Co.
Valley Iron Works Co.
Westinghouse Electric Corp.

HOSE (Air, Water, Suction, etc.)
The Goodyear Tire & Rubber Company

HUMECTANTS
Aktivin Division, Heyden Chemical Corp.
Nopco Chemical Co.
Wyandotte Chemicals Corp., Michigan Alkali Div.

IMPREGNANTS
American Cyanamid Company, Industrial Chemicals Division
B. F. Goodrich Chemical Co.

INDENTING MACHINES
Dilts Machine Works

INDUSTRIAL TRACTORS
Clark Equipment Company, Industrial Truck Division
Towmotor Corp.

INKOMETER
Thwing-Albert Instrument Co.

INSTRUMENTS, TESTING AND MEASURING
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Brown Instrument Co.
Bunge Pulp & Paper Co.
General Electric Company
W. & L. E. Gurley
National Technical Laboratories
B. F. Perkins & Son
Photovolt Corp.
Taylor Instrument Cos.
Testing Machines, Inc.
Thwing-Albert Instrument Co.
Williams Apparatus Co.

JOINTS
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Lovejoy Flexible Coupling Co.
Shartle Bros. Mch. Co.

JORDAN FILLINGS
Appleton Machine Co.
Baer Brothers Mfg. Co.
E. D. Jones & Sons Co.
Shartle Bros. Mch. Co.
Smith & Winchester Mfg. Co.
Valley Iron Works Co.

KNIVES
Black Clawson Company
Dilts Machine Works, Inc.
Hamblet Machine Co.
Heppenstall Company
E. D. Jones & Sons Co.
The Moore & White Co.
Simons Worden White Co.
Taylor Stiles & Co.
Valley Iron Works Co.

KNOT BORING MACHINES
DeZurik Shower Company

KRAFT WRAPPING PAPERS
Canadian Newsprint Supply Co.

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LABORATORY EQUIPMENT
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Bauer Brothers Co.
Beckman Instruments, Inc.
Bird Machine Company
Dilts Machine Works
W. & L. E. Gurley
Egan, Frank W., & Co.
E. D. Jones & Sons Co.
National Technical Laboratories
Taylor Instrument Companies
Testing Machines, Inc.
Valley Iron Works Co.
John Waldron Corp.
Williams Apparatus Co., Inc.

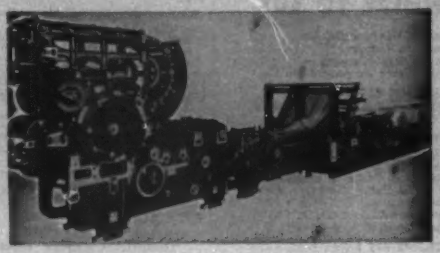
LAMINATING MACHINES
Dilts Machine Works
Egan, Frank W., & Co.
John Waldron Corp.

LAY BOYS
Dilts Machine Works
Gibbs-Brower Company, Inc.
Hamblet Machine Co.
Moore & White Co.

LIFT TRUCKS
Clark Equipment Company, Industrial Truck Division

LINTER COTTON
Railway Supply & Mfg. Co.

LUBRICANTS
Gulf Refining Co.
Sinclair Refining Co.



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Stephens-Adamson Mfg. Co.
The Wellman Engrg. Co.

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Lobdell Co.
Stephens-Adamson Mfg. Co.
Testing Machines, Inc.

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Moore & Munger

PALLET TRUCKS
Clark Equipment Company
Industrial Truck Division

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Williams Apparatus Co., Inc.

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Fairbanks, Morse & Co.
General Electric Company
Reliance Electric & Engrg. Co.

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Canadian Newsprint Supply Co.

NICKEL AND NICKEL ALLOYS
The International Nickel Co.

NOZZLES
Link Belt Company

PACKING BOXES
Johnson Corporation
The Moore & White Co.
Shartle Brothers Machine Co.
Clark Equipment Company
Industrial Truck Division

PAPER MACHINE DRIVES
Manchester Machine Co.

PAPER MACHINES
Bagley & Sewall Co.
Black Clawson Company
Downingtown Mfg. Co.
Gibbs-Brower Company, Inc.
Thomas W. Hall Co.
Lakewood
Moore & White Co.
Pusey & Jones Corp.
J. J. Ross Company
Ross Paper Machy. Corp.
The Sandy Hill Iron & Brass Works
Shartle Brothers Machine Co.
Smith & Winchester Mfg. Co.

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Frank W. Egan & Co.
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Potdevin Machine Co.
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Waldron Corp., John

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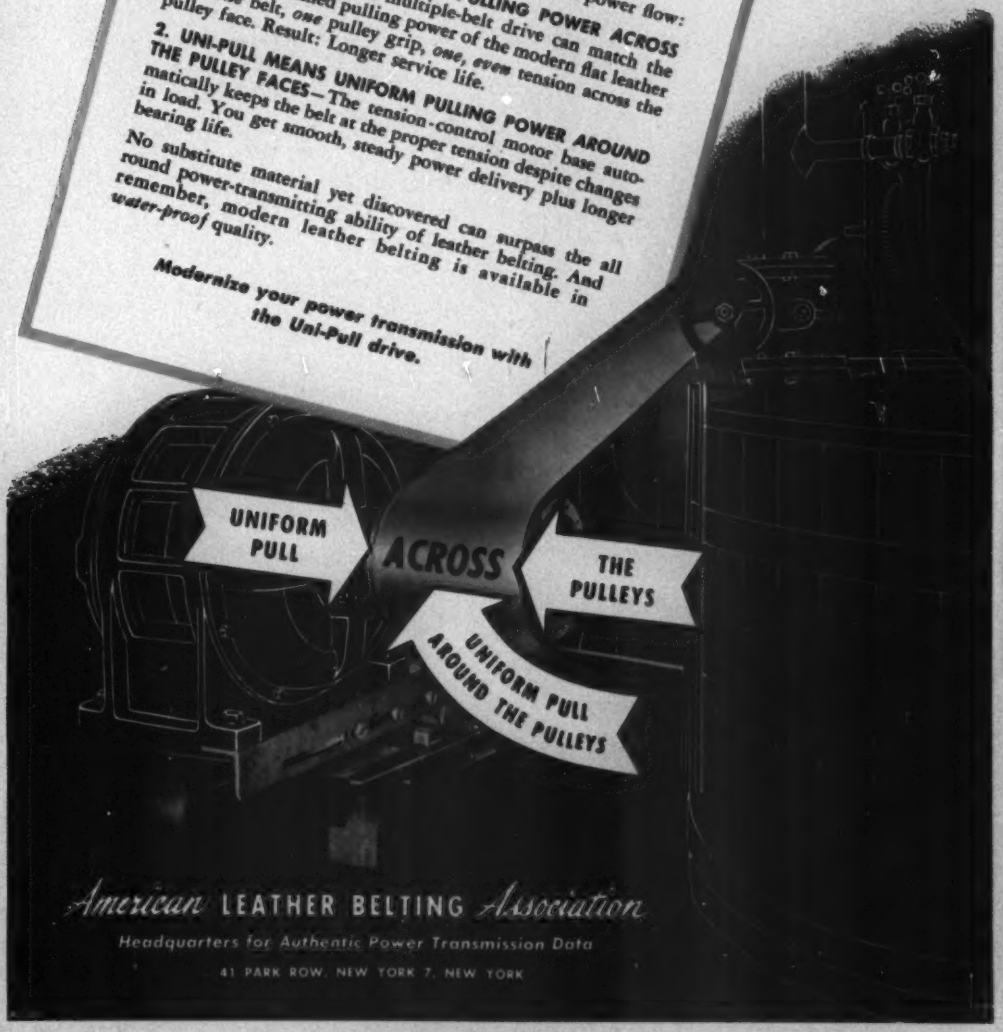

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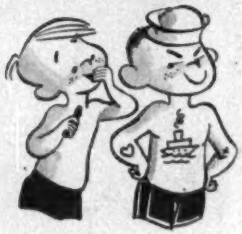

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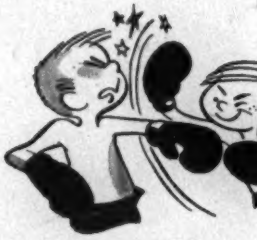

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